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HIGH INTENSITY MERCURY VAPOR LAMPS AND EQUIPMENT

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Westinghouse

HIGH INTENSITY MERCURY VAPOR LAMPS AND EQUIPMENT

ISSUED BY
COMMERCIAL ENGINEERING DEPARTMENT
WESTINGHOUSE LAMP COMPANY, BLOOMFIELD, NEW JERSEY
AND
LIGHTING DIVISION
WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, CLEVELAND, OHIO

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INDEX TO SECTIONS

Page

Characteristics and Purpose of High Intensity Mercury Vapor Lamps 1

Commercial Aspects of High Intensity Mercury Vapor Lighting 9

Westinghouse High Intensity Mercury Vapor Lamp, Sales Engineering Notes No. 124-A 17

High Intensity Mercury Vapor Light 21

Terms and Conditions of Sale of High Intensity Mercury Vapor Lamps 22

Adjustments on High Intensity Mercury Vapor Lamps 25

Reflectors and Accessories for 400-watt High Intensity Mercury Vapor Lamps . . . 27

Industrial Lighting Equipment, Price Supplement 29

Confidential Instructions and General Discounts 30

Designing the Installation 34

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CHARACTERISTICS AND PURPOSE OF HIGH INTENSITY MERCURY VAPOR LAMPS

Mercury vapor activated by an electrical discharge has been used for a number of years as a source of light. The major proportion of the exploitation of this type of lighting was carried on by the Cooper-Hewitt Company, later known as the Vapor Lamp Division of the General Electric Company. The light source is tubular approximately 1" in diameter, 50" long and contains a considerable quantity of mercury along with the necessary electrodes. It is supported in a special reflector and housing which also contains the necessary transformer, resistances, choke coils and starting mechanism. The efficiency of the tube itself is approximately 14.3 lumens per watt consuming 385 watts. The entire apparatus for its operation including the transformer and other devices, consumes 450 watts with an overall efficiency of approximately 12.2 lumens per watt. It generates approximately 5500 lumens of greenish-blue light. For a while, mercury vapor did not receive much attention as a light source other than in the form of this lamp as it was believed that no great improvements in efficiency could be had and much higher efficiencies could be obtained from tungsten filament lamps. However, it was later found that mercury vapor could be used as a highly efficient light source if operated at the proper pressure. The color of the light produced could be varied somewhat depending upon the pressure used. This new line of investigation paved the way for the development of the new high intensity mercury vapor lamp. This new lamp has many advantages over the old low

intensity type mentioned above being considerably smaller, about 13" in length and 2" in diameter, equipped with a standard mogul base. It produces a light, richer in yellow which is not so ghastly in appearance as that obtained from the old low intensity type. It operates at an efficiency of 35 lumens per watt, producing 14,000 lumens.

It consists of two tubular bulbs - one within the other, the inner one being equipped with two electrodes one at each end known as the arc tube. In addition to the two electrodes, this inner or arc tube contains a small amount of carefully measured and purified mercury along with a few millimeters of argon - the argon being used to facilitate the starting of the arc discharge. The outer tube is used solely as a heat conserver also serving as a protection for the current carrying leads attached to the electrodes.

The arc tube is wrapped with a small piece of wire mesh which facilitates the initial establishment of the arc.

The electrode used in the mercury lamp is somewhat different from those used in the sodium lamps. The electrodes are known as the cold hot cathode type. By this we mean that they are not heated prior to the establishment of the arc. For this reason, the voltage required for the initial arc is considerably higher than that of the sodium lamp. When the lamp is first placed in operation, a faint blue discharge appears within the arc tube producing very little light but as operation continues and the temperature of the lamp gradually increases, the mercury in the arc tube vaporizes and the light becomes more brilliant until all the mercury has been converted into vapor and the lamp

has then reached full operating efficiency. During this period the volt ampere characteristics of the lamp are of interest as shown graphically on the second page of Sales Engineering Notes No. 124-A included in this folder. It will be noted that as soon as the discharge is established that a current flow of 5 amperes is obtained with a drop of 18 volts. As the mercury vaporizes, the lamp voltage rises and the current falls until it reaches approximately 2.9 amperes and the voltage is 155.

There have been instances where a prospective customer will buy a few lamps and test them privately for voltage and current. After this procedure, he will subject the lamp to criticism on the basis of lack of uniformity of voltage and current. It must be understood that the characteristics of the vapor lamps are entirely different than those of tungsten filament lamps with which we have so long been familiar. All mercury vapor lamps will not have the same operating voltage. Individual lamps will vary anywhere from 140 to 160 volts and from 2.55 to 3.25 amperes. This variation is caused by slight differences in the amount of mercury used and in variations in the thickness of the glass of the arc tube but does not in any way affect the life. Altho the lamp is rated at 400 watts, a variation of plus or minus 10% is permissible. A similar range of variation in lumens is also permitted. One of the peculiar characteristics of this lamp is that its operating voltage remains constant even if the wattage input is increased.

Under these conditions, the current only rises. Altho the mercury lamp produces some light during its initial stage of operation, approximately 10 minutes is required for it to reach

full brilliancy at this time having a light output of approximately 14,000 lumens consuming 400 watts with an efficiency of 35 lumens per watt.

The present lamp, however, has two drawbacks - first, it can only be operated in a vertical position and, secondly, should its operation be interrupted some 15 or 20 minutes will be required before the arc will again be established. This last objection is the cause of considerable criticism in the field and steps are being taken to reduce the restarting time. Inasmuch as such a change involves much research and development work, we are unable to state just when we will be in a position to supply a lamp with this improvement. We hope that we can ultimately reduce the time necessary for restarting the lamp when hot which will, undoubtedly, overcome a certain amount of field criticism which is now encountered due to the lamp fixtures of some circuits being in darkness for quite a few minutes in case of momentary failure of the electrical circuit. Altho there are some customers who do not look upon this possibility with any great seriousness, you will find others who strongly object to it. There is one large installation where a standby Mazda lamp system is installed to take care of such a situation. Complete failure of the lighting circuit is not the only cause for the arc to extinguish. Some manufacturing plants have wide fluctuations in voltage particularly where electrical machines are employed which place great loads suddenly upon the line. If the momentary voltage drop caused by this load is great enough, the lamp will be extinguished and will not restart until it has cooled sufficiently. It was stated above that the lamp only operates in a vertical

position. It will, however, operate horizontally for a very short time but should such operation be attempted, the arc stream will bow striking against the arc tube, finally melting it and destroying the lamp.

The 400 watt high intensity mercury lamp must be operated in conjunction with a transformer or reactor especially designed for it in order that the proper starting voltage and current limitation may be had. Where 110 - 125 volt circuits are available, a transformer should be used. Where the circuits of 208 - 240 volts are available, reactors should be used. Due to the characteristics of these devices the power factor is low being in the neighborhood of 60% and in places where this is objectionable, it is necessary to correct this condition by the use of condensers. These current limiting devices made by the Lighting Division of the Westinghouse Elec. & Mfg. Co., Cleveland, can be had with or without the power factor condenser compactly built into one unit. Total power consumption for the entire fixture including transformer losses is 440 watts.

In order to meet various voltage conditions, the transformers are equipped with three taps labelled 107, 115 and 123 volts. In general, the 107 volt tap should be used where the voltage supply ranges from 105 to 110 volts. The 115 volt tap is used when the voltage supply is within the range of 110 - 120 volts and the 123 volt tap should be used where the voltage supply is from 120 to 125. The reactors are tapped for 208, 220, 230 and 240 volts. The tap to be used is that which most nearly conforms with the actual line voltage. With transformer operation with condensers for the correction of power factor, the current drain

on the line during the first five or six minutes of operation, is about 7 amperes. When the lamp reaches full operation, this drops to about 4.5 amperes. For this reason only three lamps can be operated on one circuit fused for 25 amperes. On systems where reactors are used in conjunction with condensers for power factor correction, the current drain on the line during the first five or six minutes of operation is approximately 5 amperes. After the lamp has reached full operation, it drops to 2.9 amperes. It will be seen that approximately 5 lamps can be operated under such conditions on lines fused for 25 amperes.

The 400 watt size of high intensity mercury lamp is best suited to the industrial lighting field. Inasmuch as the light from the mercury lamp is deficient in red and orange, it is not suitable for commercial lighting or where discrimination of color is desired. A full line of industrial fixtures is now available from the Lighting Division of the Westinghouse Elec. & Mfg. Co., Cleveland. The line is being augmented with new styles as field requirements demand. At the present time, a large Glassteel unit complete with transformer or reactor is available and should be used where the finest type of industrial lighting is required when the mounting height used will vary from 10 to 18 ft. With a higher mounting height, Highway reflector fixtures complete with transformers or reactors are available in three styles, namely, low, medium and high mounting. In connection with these units, one point to remember is that Westinghouse is the only company that can supply a complete fixture and lamp. There are, of course, others on the market which consist of a reflector made by one manufacturer and

transformer and lamp made by another.

It appears that the most fertile field for the introduction of this new type of lighting is in establishments where the old low intensity type Cooper-Hewitt lighting is now used. Many thousands of these lamps will be found in automotive plants, textile mills, foundries, machine shops, wire plants, etc. These places are already accustomed to the peculiar color of mercury light and appreciate its advantages from a standpoint of vision. Wherever possible, try to get a small installation of at least four high intensity mercury fixtures in a location where Cooper-Hewitt lamps are now used. The result obtained will not only be surprising to your prospective customer but to yourself as well. When the fixtures are mounted at the same height as the existing Cooper-Hewitts, they will produce about twice the intensity of illumination with approximately the same wattage consumption. If an existing Cooper-Hewitt installation should be replaced lamp for lamp by high intensity mercury fixtures, the cost of such an installation would be somewhat greater than the Cooper-Hewitt installation but if an installation is made to produce a given footcandle intensity, then the total cost of the high intensity mercury installation would be less than the Cooper-Hewitt installation unless the power rate is less than 1/2¢ per KWH. Elsewhere in this folder will be found comparative costs of a lighting installation using high intensity mercury lamps, low intensity Cooper-Hewitt lamps or Mazda lamps. It will be noticed that the high intensity mercury installation will compete with the Cooper-Hewitt installation under all normal power rate conditions. The Mazda lamp installation, transformer and lamp made by another.

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For the present at least, we do not think it desirable to attempt competition with Mazda lamps by means of high intensity mercury lamps against the problem of cost. However, in cases where the prospect already favors or can be sold on the advantages of the peculiar color quality of mercury light, the difference of cost in favor of Mazda installation will not be of such great importance.

It is generally known that vision improves as the light used approaches monochromatic quality. Of course, the light from the high intensity mercury lamp cannot in any sense be considered monochromatic but it more nearly approaches this quality than does the light from a Mazda lamp. The Mazda lamp produces all of the wave lengths in the visible spectrum whereas the mercury lamp produces only three. Therefore, with mercury vapor lighting, the eye need not continually adjust itself to obtain the proper focus for all wave lengths but can confine its work to focusing on only three wave lengths. This results in great sharpness and acuity of vision and less fatigue. Appreciate, of course, that this is all theoretical but an actual trial with this form of lighting will show how well one may see with it. All objects appear to stand out in greater contrast and detail.

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COMMERCIAL ASPECTS OF

HIGH INTENSITY MERCURY VAPOR LIGHTING

1. INDUSTRIAL LIGHTING

Within the Industrial Lighting field we find our greatest immediate potential for Mercury lamp business. This potential in the industrial field exists in any place where low pressure mercury lamps are now in use or their use contemplated. Our salesman should solicit the business of those industrial institutions who are now using Low Intensity Mercury lamps and where it is necessary to obtain the same lighting effects for additional space, or in industrial institutions where it is desirable or necessary that they obtain the mercury color.

The following table shows the comparative operating costs of Low Intensity, High Intensity Mercury Vapor and the Mazda industrial installation.

It should be borne in mind that the figures in the table apply only to an initial or new installation.

In the case of a solicitation which involves the extension of mercury light due to additional space, the following comparative chart supplies all of the ammunition necessary to prove to the prospect that High Intensity Mercury Vapor lighting is the most satisfactory and economical.

The chart also tells the same story for those industrial institutions where it is necessary that they obtain mercury color and are planning to install a lighting installation.

Comparative Costs for Lighting Installation Using High Intensity Mercury Vapor Lamps; Low Intensity Mercury Vapor Lamps; or 750 Watt Mazda Lamps, Fixtures at a Mounting Height of 15 Ft. to Produce an Average Illumination of 10 Footcandles over an Area of 10,000 Sq. Ft. and Operated for 2000 Hours per Year.

		High Intensity Mercury Vapor Lamp In Glass Steel Diffuser	Low Intensity Mercury Fixture	750 Watt Mazda Lamp in Glass Steel Diffuser
1. Watts per Fixture		440	452	750
2. Average Lamp Life - Hours		1500	6000	1000
3. Useful lumens per Fixture		8555	3500	8555
4. Initial Cost of Fixture		$27.58*	$15.00	$12.58
5. Cost of Lamp Net		$10.62	$10.00	$ 2.51
6. Interest, Taxes, Insurance -(10% of Line 4)		$ 2.76	$ 1.50	$ 1.26
7. Depreciation (15% of " 4)		$ 4.14	$ 2.25	$ 1.89
8. Non-Operating Overhead (Line 6 & 7)		$ 6.90	$ 3.75	$ 3.15
9. Annual Burning hrs. per fixture		2000	2000	2000
10. Annual Cost of Lamp Renewals per Fixture		$14.16	$ 3.33	$ 5.02
11. Annual Power Cost per Fixture at KWH Rate of:	5¢	$44.40	$45.20	$75.00
	4¢	35.20	36.16	60.00
	3¢	26.40	27.12	45.00
	2¢	17.60	18.08	30.00
	1¢	8.80	9.04	15.00
13. Total Annual Cost per Fixture (8 & 10 & 12) at Rate of:	5¢	$65.06	$52.28	$83.17
	4¢	56.26	43.24	68.17
	3¢	47.46	34.20	53.17
	2¢	38.66	25.16	38.17
	1¢	29.86	16.12	23.17
14. No. of Fixtures required		27	57	27
15. Total Annual Operating Cost of Installation (13x14) at KWH Rate of:	5¢	$1756.62	$2979.96	$2245.59
	4¢	1519.02	2464.68	1840.59
	3¢	1281.42	1949.40	1435.59
	2¢	1043.82	1434.12	1030.59
	1¢	806.22	918.84	625.59

* Includes transformer or reactor.

It is rather difficult to list here specific industrial fields where it can be definitely said high intensity mercury vapor lighting could be used to advantage. Of course, as mentioned before, we know that present users of Low Intensity Mercury lamps are prospects. It is logical to assume that if a certain industry or section of an industry is successfully using Mercury, that similar industries or sections of industries not using them should be prospects.

We give below a partial list of industries which experience so far indicates can use High Intensity Mercury Vapor Lighting.

Steel Mills	General Lighting
Foundries	" "
Locomotive Works	" "
Cotton Mills	Spinning
Woolen Mills	"
Silk Mills	"
Other Textile Mills	"
Machine Shops	General Lighting
Milling and Smelting Plants	" "
Automobile Manufacturers	Assembly
Publishing and Printing	Press and Composing Rooms
Post Offices	Sorting

2. FLOODLIGHTING.

In discussing Floodlighting we consider floodlighting of buildings of all types.

No time should be spent by our sales organization in the solicitation of Mercury lamp business for floodlighting of buildings where the following conditions (a) and (b) apply.

(a) A great percentage of the floodlighting problems involves the projection of light beams for a considerable distance. Due to the fact that the High Intensity Mercury Vapor Lamp has such a long light source it is practically impossible with the equipment available today to obtain proper control of the light beams for this long range floodlighting.

(b) The light produced by the High Intensity Mercury Vapor Lamp is deficient in red and orange and, therefore, objects of these colors will not appear in their true color value.

However, in instances where the light is to be projected for short distances and where the color scheme involves the use of blues, greens, yellow and white, as well as black, startling lighting effects may be obtained by the use of Mercury light.

We believe that a potential field exists with automotive service stations who use light to such a great extent for advertising purposes and night time identification. Some of the larger standard floodlighting fixtures of the open reflector type now available for Mazda lamp use can be used with the High Intensity Mercury Vapor lamp. All floodlighting inquiries or jobs should be handled together with or turned over to a representative of the Lighting Division of the Electric Company. The following table shows the comparative operating costs of floodlighting with High Intensity Mercury Vapor versus Mazda. The table is based on the floodlighting of an average sized filling station where four 1000 watt Mazda lamps in open reflectors would be required.

		High Intensity Mercury Vapor Lamp in Open Type Floodlight		1000 Watt Mazda Lamp in Open Type Floodlight
1. Watts per Fixture		440		1000
2. Average Lamp Life - Hours		1500		1000
3. Useful Lumens per Fixture		7700		13,000
4. Initial Cost of Fixture		$30.00		$ 9.80
5. Cost per Lamp Net		$10.62		$ 3.00
6. Interest, Taxes, Insurance - (10% of Line 4)		$ 3.00		$ .98
7. Depreciation (15% of Line 4)		$ 4.50		$ 1.47
8. Non-Operating Overhead (Line 6 & 7)		$ 7.50		$ 2.45
9. Annual Burning Hours per Fixture		1500		1500
10. Annual Cost of Lamp Renewals per Fixture		$10.62		$ 4.50
11. Annual Power Cost per Fixture at KWH rate of:	5¢	$33.00	5¢	$75.00
	4¢	26.40	4¢	60.00
	3¢	19.80	3¢	45.00
12. Total Annual Cost per Fixture (Line 8 & 10 & 11) at rate of:	5¢	$51.12	5¢	$81.95
	4¢	44.52	4¢	66.95
	3¢	37.92	3¢	51.95
13. No. of Fixtures Required		8		4
14. Total Annual Operating Cost of Installation (Line 12x13) at KWH rate of:	5¢	$408.96	5¢	$327.80
	4¢	356.16	4¢	267.80
	3¢	303.36	3¢	207.80

3. HIGHWAY LIGHTING

In discussing Highway Lighting, we consider the lighting of such areas as constitute highways in the open country where there is no pedestrian traffic and where residences are almost entirely lacking.

The use and application of High Intensity Mercury Vapor lamps in highway lighting is such a controversial subject that we recommend that our sales representatives do not become involved in this type of negotiation but refer any inquiries which they may receive to the lighting section of the Parent Company.

In the lighting of highways the color is not a factor. We recommend the use of the Sodium light rather than Mercury for this purpose. The Sodium Vapor lamp is highly efficient, the wattages of the lamps available are relatively low, the light itself non-glaring and conducive to high visibility. Most important of all Westinghouse has available the finest highway lighting luminaire on the market. The Westinghouse Butterfly Sodium luminaire, is at present available for the 6,000 lumen size Sodium lamp and is of the open reflector type using no enclosing glassware, and the control and reflection of the light beams is obtained through the use of especially formed and treated aluminum vanes. Our competitor has a highway sodium luminaire, known as the Airplane luminaire, that requires the 10,000 lumen sodium vapor lamp.

The results of laboratory tests as well as actual comparisons on the highway indicate that our 6,000 lumen Butterfly fixture, consuming 180 watts, produces as good, if not slightly better, highway lighting than our competitor's Airplane fixture, using a 10,000 lumen lamp and consuming 250 watts. A very good comparison of these two highway luminaires may now be seen on the new Allegheny River Boulevard, just outside the city of Pittsburgh.

4. STREET LIGHTING

In Street Lighting we are concerned in the illumination of thoroughfares passing through business, mixed business and residential or purely residential areas.

In all such areas color is an important factor due to the presence of sidewalks and their pedestrian traffic, and the fronts of residences, stores and buildings within the lighted area. There are some who feel that the color of mercury light would be objectionable in such areas where show-windows are

present. However, we feel that in all such cases these windows have their own lighting systems and, therefore, color distortion from the light of the mercury lamps in the street fixtures would not be encountered.

This subject of street lighting like highway lighting is much involved, and we would suggest that you refer such inquiries to the lighting representative of the Parent Company who specializes in such problems.

5. COMMERCIAL LIGHTING FIELD

No time should be spent in the solicitation of High Intensity Mercury Vapor Lighting business in the commercial field because of the color effects obtained from Mercury Vapor light. Of course, the disadvantages of the mercury coloring can be offset by the use of combination lighting, that is, Mazda together with Mercury. At the present time we are not in a position to talk combination lighting, the details of which are discussed in Chapter 6 of this write-up.

6. COMBINATION LIGHTING -
i. e. Mazda and High Intensity Mercury Within the same Fixture

It is well known that the light from the Mazda lamp is rich in yellow and red, and in the past where a white light is desired it has been the practice to filter out certain proportions of red and yellow and thereby obtain a light of whiter quality. This is known as a subtractive method. It is very inefficient as some of the energy used to produce red and yellow is lost by the absorbtion of the filter.

Inasmuch as the light from the mercury vapor lamp is rich in blue and green, and almost entirely deficient in red, a proper combination of this light with that of a Mazda lamp (rich in red) will result in a close approximation of white light produced at much greater efficiency. This means of obtaining white light is known as the additive method.

Up to the present time the development of such fixtures has not been completed.

7. ROUTINE FOR HANDLING HIGH INTENSITY MERCURY VAPOR LIGHTING INQUIRIES

It is necessary that all departments and individuals concerned should be kept informed regarding field negotiations and inquiries during the embryonic period of High Intensity Mercury Vapor Lamp development. In order to make certain that this is so, the following practice should be enforced immediately.

On any High Intensity Mercury Vapor or Sodium Vapor lighting solicitations, a report should be written in detail and sent by our representative to his Division Manager. The Division Manager should at once transmit this material together with his comments to Mr. F. Kohnstamm, Westinghouse Electric & Manufacturing Company, Cleveland, Ohio. A copy of this letter to be sent to the Electric Company lighting representative in the territory involved, and a copy to Mr. A. B. McKenna, Commercial Engineering Department, Bloomfield, N. J. Mr. McKenna will be charged with the full responsibility of following up all negotiations and inquiries through our field representatives and to assist in the coordination of the Lamp Company with the Lighting Division of the Electric Company.

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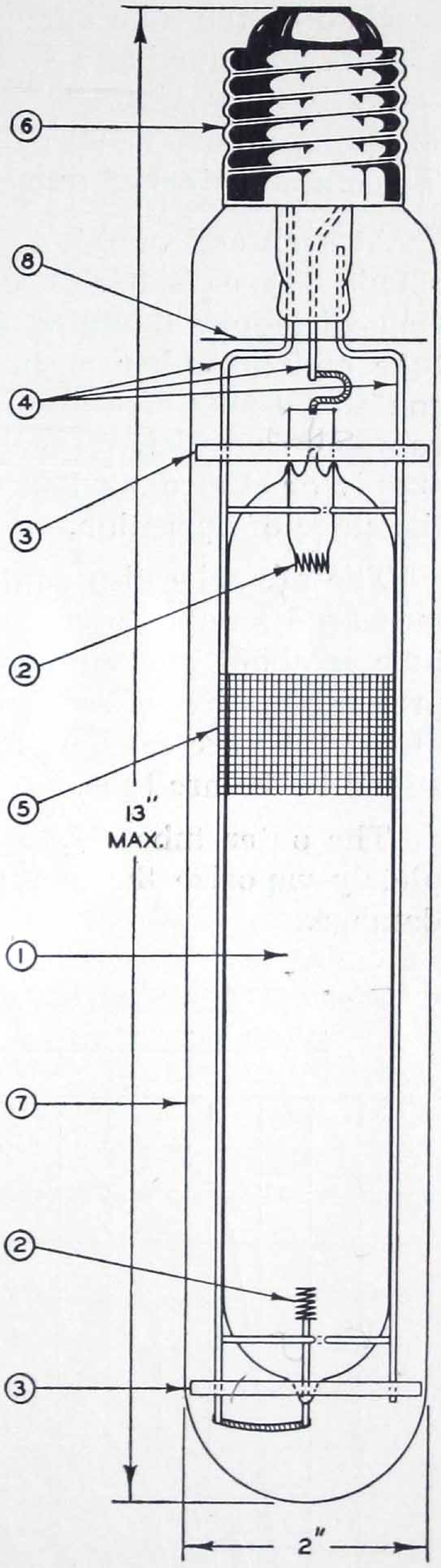
WESTINGHOUSE HIGH INTENSITY MERCURY LAMP

ltho the tungsten filament lamp has undergone many changes improvements since its original development in 1907, lamp ırch engineers recognize that efficiencies today, approxi- ly 15 to 20 lumens per watt, are approaching the maximum nable for a reasonable life and practical light source. Thus y considerable increases in efficiency are to be obtained some ıod of producing light must be used other than the heating ılids to incandescence.

'he natural trend in this line of development was along that minous gases. However, it was found that altho various gases ld produce startling and interesting light sources, the effi- cies obtained were considerably lower than those already hed by tungsten lamps. Undaunted by many obstacles and ated failures, Westinghouse research engineers have quietly inued their explorations of the light producing qualities of ous gases and vapors. They found that the light producing iency of mercury vapor could be greatly increased if its pres- was increased somewhat above the former operating level.

'here is now available from the Westinghouse Lamp Com- a High Intensity Mercury Vapor lamp (Fig. 1) having an iency of approximately 35 lumens per watt. This is the great- dvance in lamp efficiency since the development of the tung- filament lamp in 1907. The lamp is 13″ long, 2″ in diameter, luces 14,000 lumens and consumes 400 watts. This size is the runner of other High Intensity Mercury lamps that will be loped in the near future depending upon demand and ser- requirements.



① ARC TUBE
② ELECTRODES
③ SUPPORTING BANDS
④ LEAD AND SUPPORT WIRES
⑤ STARTING SCREEN
⑥ MOGUL SCREW BASE
⑦ OUTER TUBE
⑧ MICA DISC

FIG. I

ESSENTIAL DATA

Bulb	Tipless T-16
Base	#401 Mogul Screw
Max. Overall Length	13 Inches
Starting Volts	220
Arc Volts	135 - 160
Watts	400 ± 10%
*Lumens Per Watt	35 ± 10%
Average Life	1500 Hours
Light Center Length	7¾ Inches
†Burning Position	Base Up
Finish	Clear

Average lumens through rated life in per cent of initial 80.

List Price: $12.50

Discounts:
- Less than standard package quantities, 0%.
- Standard package of 6 lamps, 15%.
- 10 or more standard packages, 20%.

*When tested in series with an accepted reactor or across an accepted transformer with the line voltage corresponding to the tap used.

†Lamps for base down burning positions may be had on request.

The lamp consists of two tubular bulbs—one within the other, giving it a somewhat unusual appearance. The inner bulb wherein the arc is formed is approximately 7″ long and 1⅜″ diameter and this tube is the real light source.

Due to the extremely high temperature reached by the tube during operation, a special glass is used having a softening point of 925°C —this is approximately 200°C higher than the softening point of any glass heretofore used in the common sizes of tungsten filament lamps.

At each end of this tube an electrode is located. These electrodes consist of a coil of tungsten wire—one mounted along the axis of the tube and the other perpendicular to it. Each contains a slug of a special mixture of barium compounds which serve to produce a copious supply of electrons when the lamp is in its initial stage of operation.

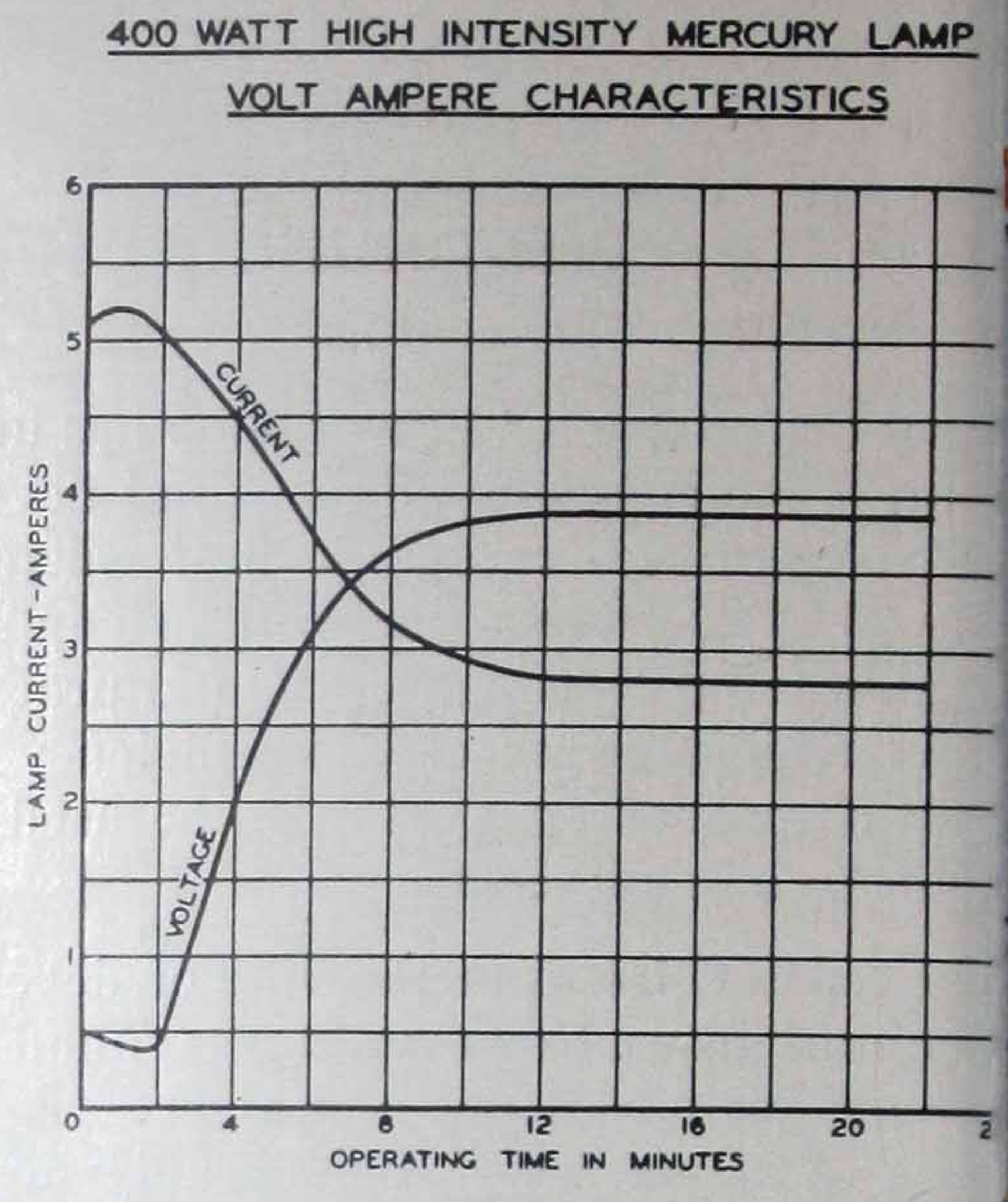


FIG 2

The arc tube also contains a very carefully measured amount of mercury such that, when completely vaporized, the pressure within tube is about one atmosphere. The amount used is very critical as any variation from proper quantity will affect the operating voltage of the lamp. In order to facilitate the establ ment of the arc discharge at the initial starting period, a small amount of pure argon gas is added to the arc tube.

The outer tube serves as a heat insulating jacket to conserve the heat generated and c pletely vaporize the mercury. It also serves to protect the inner supporting structure f damage.

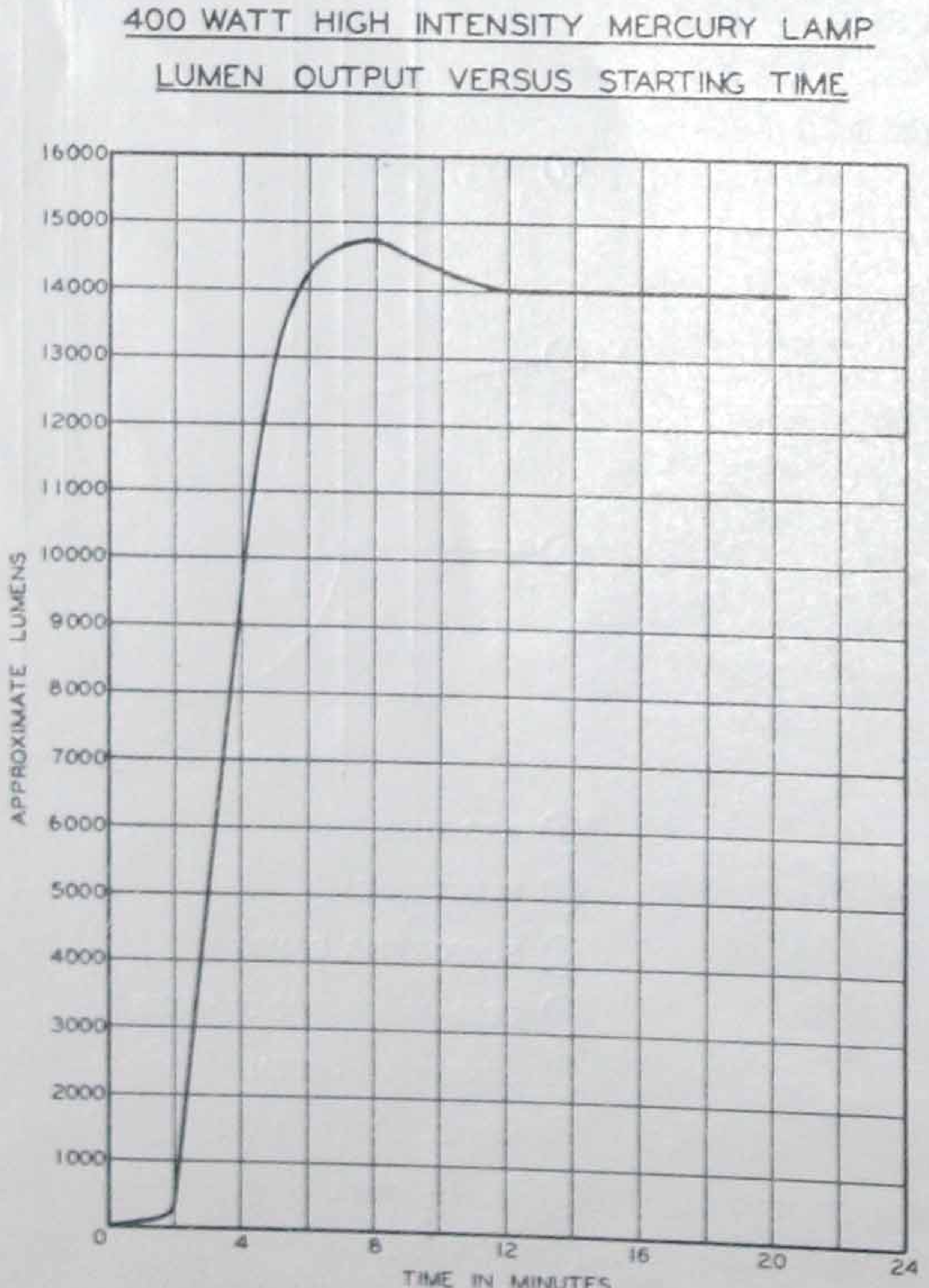


FIG. 3

For a period of about two minutes after arc is established, the lamp requires appr mately 20 volts, 5 amperes. At this stage, arc tube is filled with a blue glow of low tensity. After some ten or twelve minutes, normal operating condition is reached when lamp requires approximately 155 volts, amperes. (Fig. 2). At this stage, the glow formerly filled the entire arc tube is con trated to a narrow pencil-like arc stream great brilliancy.

During the period over which the lamp is proaching its normal operating condition, amount of light produced increases rapidly til stabilization is reached and the light ou is approximately 14,000 lumens.

In order that the arc stream may be m tained in the center of the tube the lamp mus operated in a vertical position. A devia greater than 10 degrees from the vertical cause the arc stream to bow until it touches wall of the tube which would soon melt destroy the lamp.

ould an interruption in
ectric service take place
the lamp is in opera-
the arc will be quenched
annot be re-established
the lamp has cooled
iently to reduce the
ury vapor pressure to a
where the original blue
may again be establish-
The cooling time re-
d will vary with condi-
of operation—a some-
longer time will be re-
d if the lamp is in an en-
ng type of fixture where
circulation of air is not
ble.

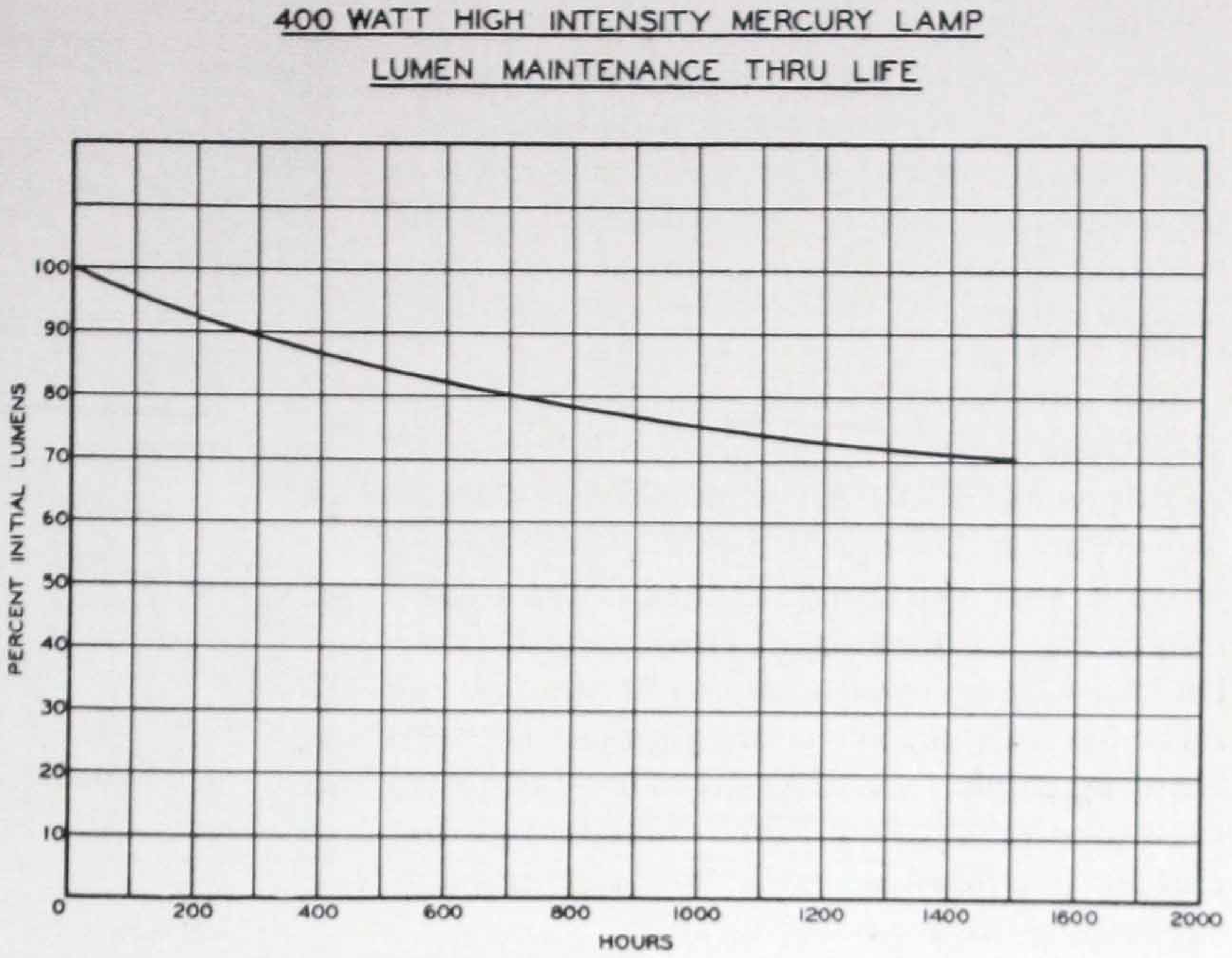


FIG. 4

e lamp is designed for
verage life of 1500 hours
a mean lumen output of
of initial. (Fig. 4).

order to operate the lamp satisfactorily, some sort of current limiting device must be
with each lamp either in the form of a transformer or reactor. When 208-240 volt service
ailable the use of an accepted reactor is necessary.

ere only the regular 105-125 volt circuits are available, an accepted transformer will be
ssary. It is essential that the wattage input to the lamp be limited to plus or minus 10%. To this end, the transformers and reactors will be equipped with several taps to meet all common service voltages.

Inasmuch as the power factor of the transformer and reactor circuits will be in the neighborhood of 60%, it is advisable to add a 20 micro-farad condenser, whereby a power factor of approximately 92% may be obtained. (Fig. 5).

As the High Intensity Mercury lamp is relatively new, there will undoubtedly be many fields for its use developed which are not now apparent. However, it is expected that considerable usage will be found for these lamps in daylight fixtures. It is well known that the light from the ordinary Mazda lamp is deficient at the violet, blue and green end of the spectrum and inasmuch as mercury light is particularly rich in these colors, the combination of the two makes possible the production of a light similar in quality to daylight.

A combination of two 400 watt High Intensity Mercury lamps and three 500 watt Mazda lamps is used in some of the Westinghouse lighting fixtures installed in the Ford Building at "A Century of Progress" in Chicago.

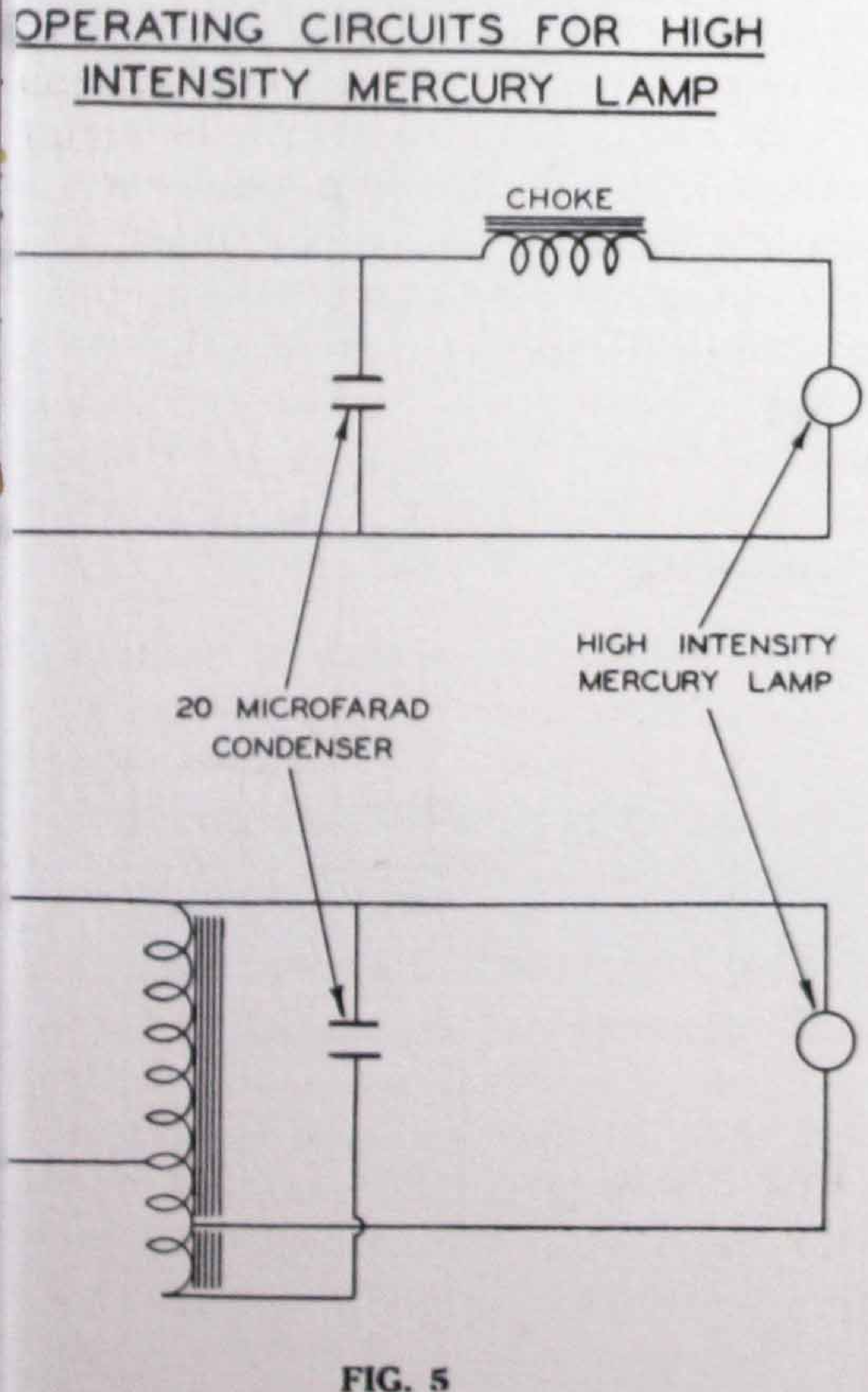


FIG. 5

Where high intensity street lighting is desired, the use of these lamps may possibly rival that of the regular Mazda lamp and, should it be found that color distortion is objectionable, it may be corrected by the addition of a sufficient amount of light from Mazda lamps.

The new lamp should also find wide applications as a general illuminant in such locations as Steel Mills, Foundries, Locomotive Works, Cotton Mills, Machine Shops, Milling and Smelting Plants, Automobile Factories, Publishing, Printing and Post Offices, where low intensity mercury lamps have been in use for some years. By substituting high intensity mercury lamps in such locations, much more efficient lighting can be provided as well as a marked improvement in the color quality.

Inasmuch as mercury light has a high actinic value, the new lamp should find considerable use in the photographic field, particularly in the photo-engraving industry.

Please note that lamps purchased may not be applied against any existing Mazda lamp contract and the list price is subject to a special schedule of discounts.

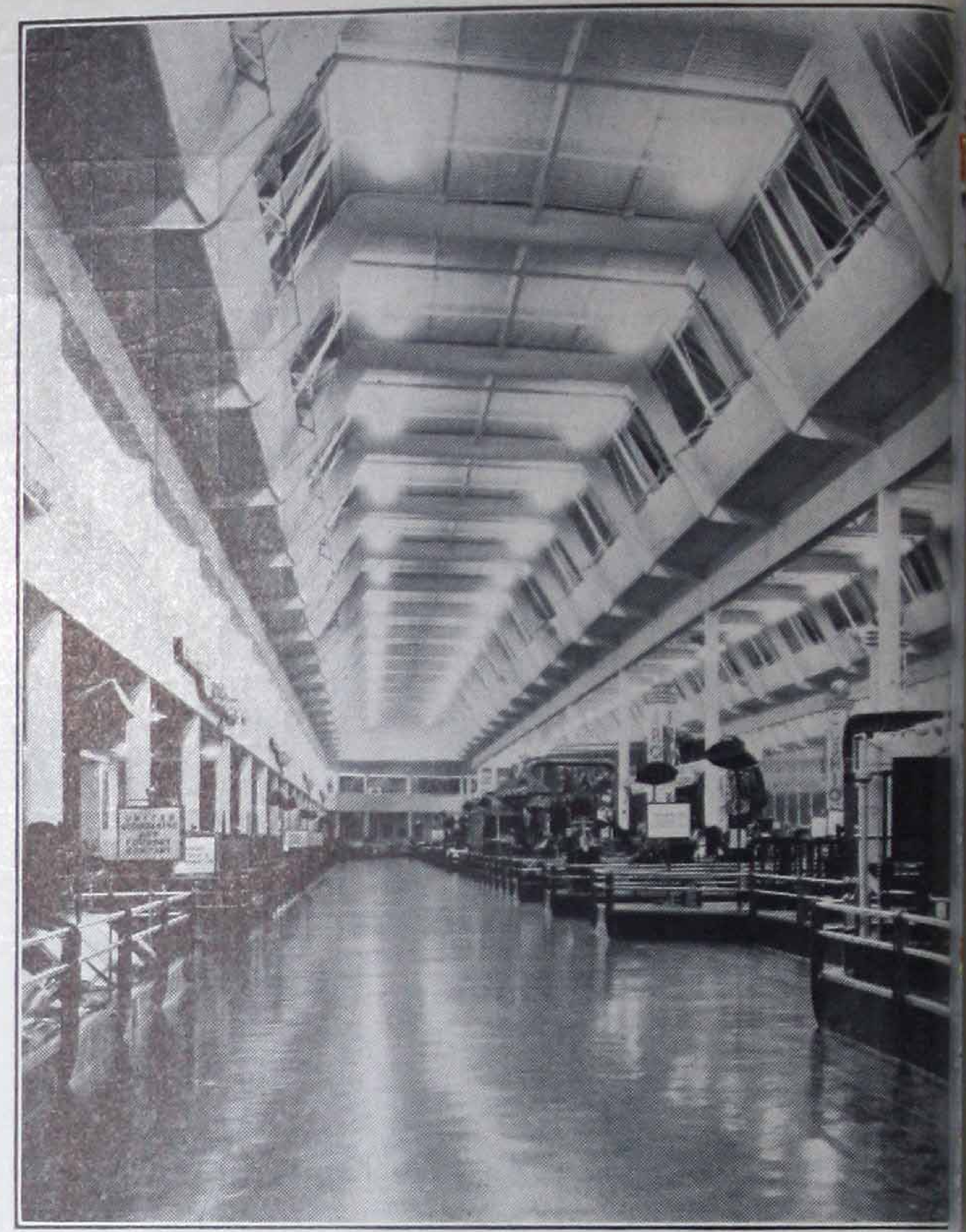


FIG. 6

FORD BUILDING INTERIOR—A CENTURY OF PR RESS EXPOSITION, CHICAGO, 1934. First commer installation of a combination of High Intensity Merc and Mazda lamps. A total of 427 Westinghouse lumina were used.

Fixtures, transformers and all accessories for the High Intensity Mercury lamp may be tained from the Westinghouse Electric & Manufacturing Company, Cleveland, Ohio.

A. B. McKENNA — J. L. McCO
COMMERCIAL ENGINEERING DEPARTM

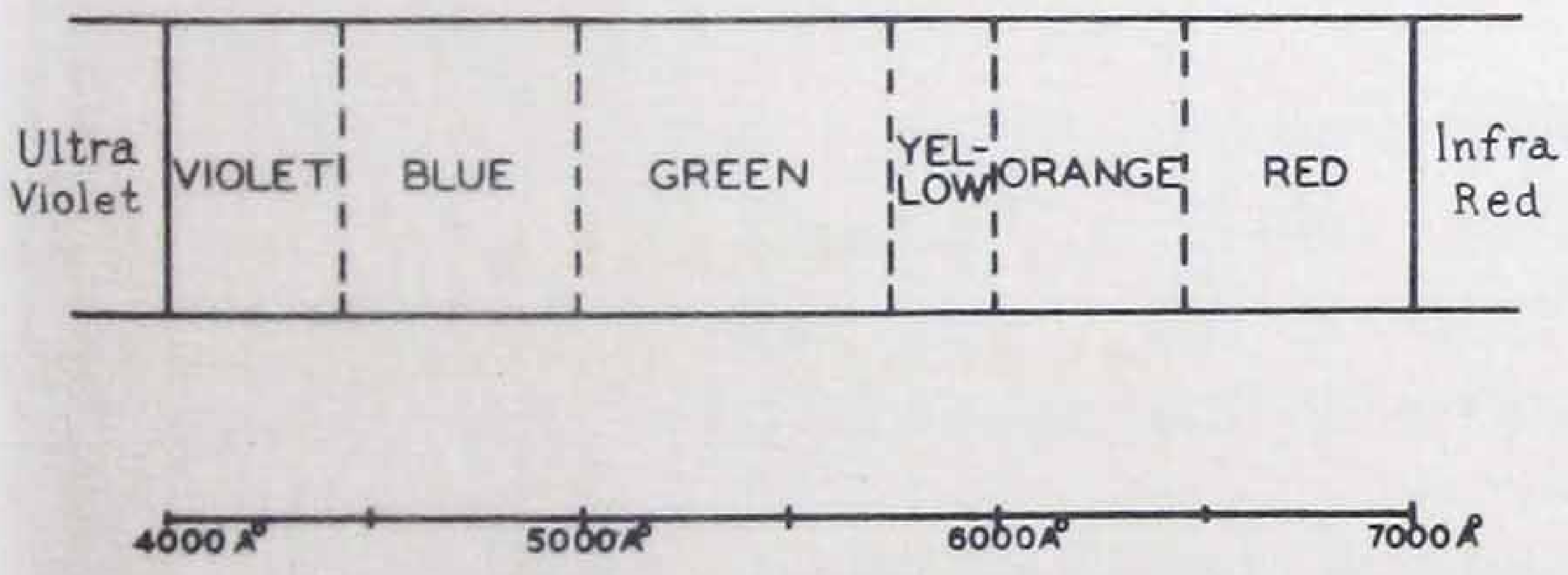
January 22, 1935

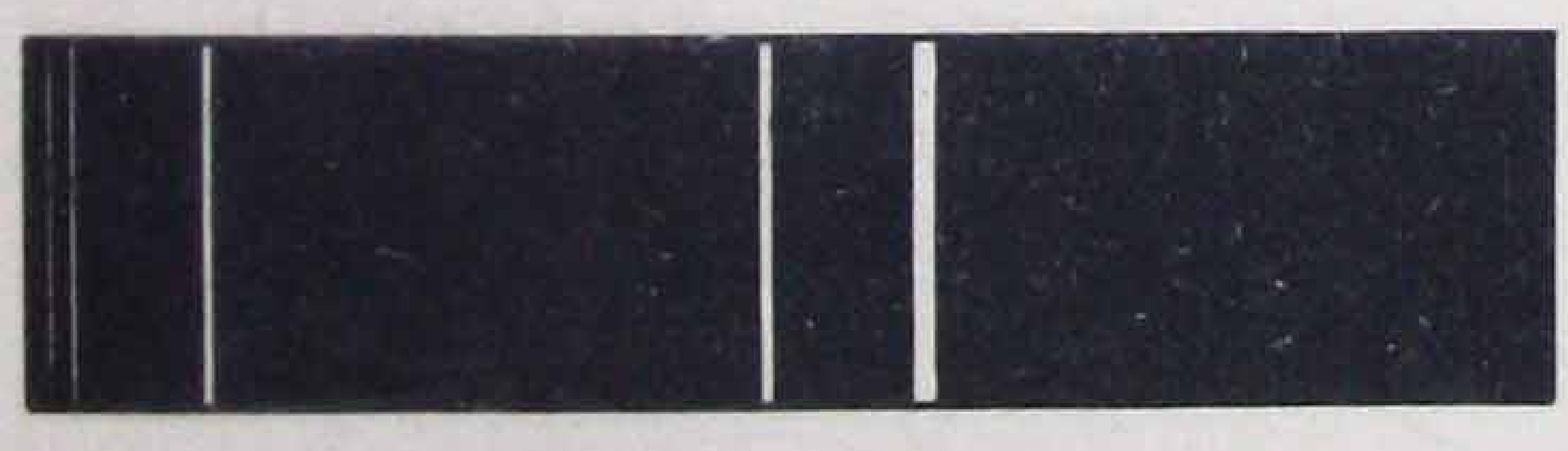
HIGH INTENSITY MERCURY VAPOR LIGHT

The light produced by the High Intensity Mercury Vapor lamp is made up mainly of wave lengths in the violet, green and yellow green portion of the visible spectrum. Most of the light produced, however, is radiated in the yellow green and green parts of the visible spectrum, near the eye's peak of sensitivity.

Objects of colors other than violet, green and yellow green, when lighted with High Intensity Mercury Vapor lamps, do not appear normal to the eye. Due to the lack of red wave lengths, red objects or those containing red will appear distorted most. A sufficient amount of Mazda light, rich in red, may be added where color discrimination is necessary.

CONTINUOUS SPECTRUM OF MAZDA LAMP

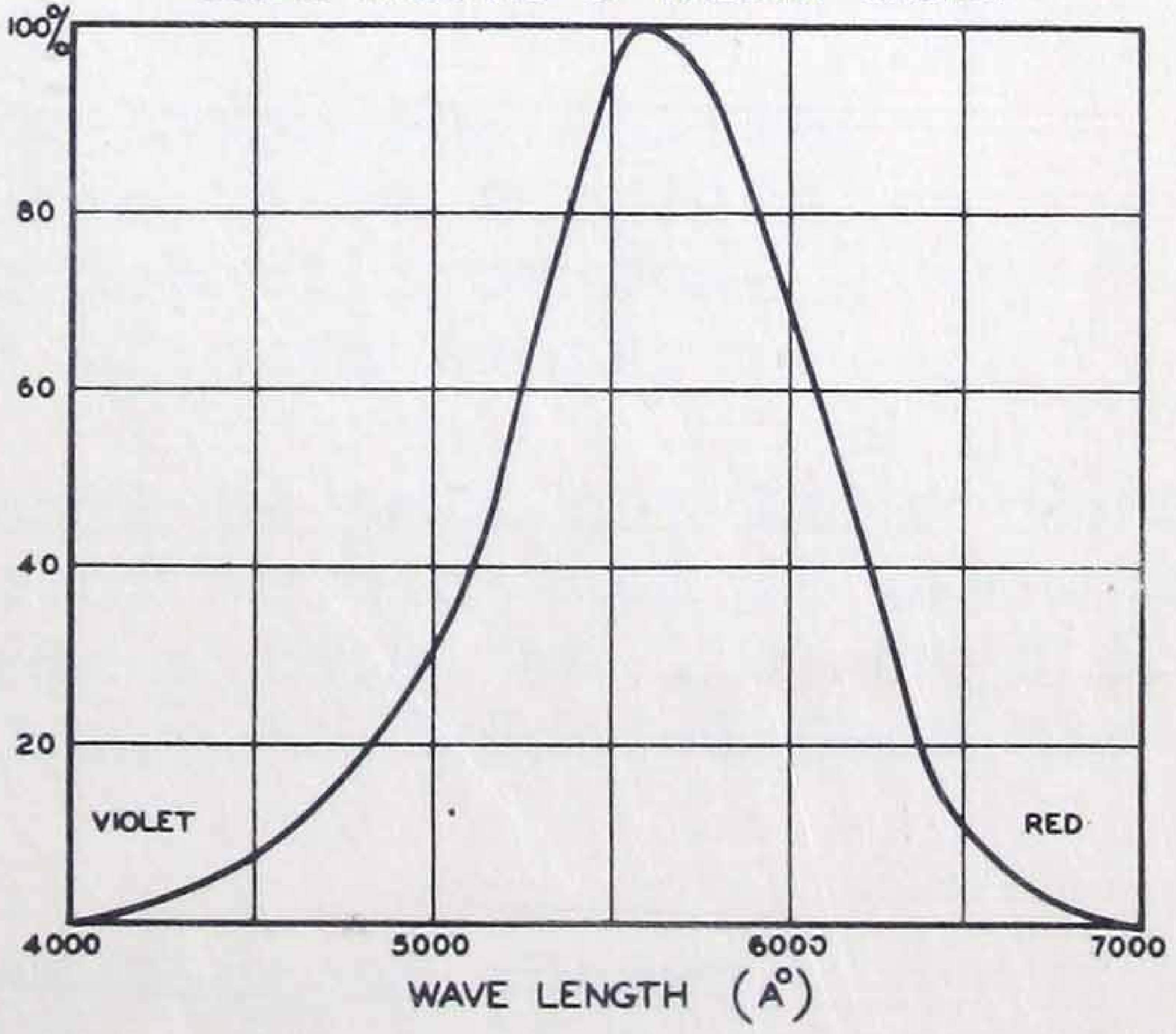




LINE SPECTRUM OF MERCURY

EYE SENSITIVITY

EQUAL AMOUNTS OF RADIANT ENERGY



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TERMS AND CONDITIONS OF SALE OF HIGH INTENSITY MERCURY VAPOR LAMPS

Effective August 1, 1934, the following plan is established for the sale of high intensity mercury vapor lamps. So far only one such lamp has been listed and the essential technical data for this lamp is given at the end of this bulletin, together with the list price:

1. High intensity mercury vapor lamps may be sold only in accordance with the following terms and conditions:

(a) Lamps listed in the Price Schedule of High Intensity Mercury Vapor lamps may be sold to consumers in domestic territory to the extent of the consumer's own requirements only at the list prices shown in the Schedule less the following discounts:

Less than standard package quantities	0%
Standard packages..................	15%
Ten or more standard packages......	20%

The above discounts apply to shipments of the designated quantities at one time to one place.

A standard package quantity will consist of six (6) lamps of the same specifications.

A consumer's own requirements will be interpreted to include the requirements of a manufacturer using lamps for initial installation in apparatus which it manufactures in which these lamps are used.

A contractor requiring lamps for initial installation in fixtures to be supplied as part of a contract job will be considered as a consumer of such lamps.

(b) All invoices for lamps shall be paid not later than thirty (30) days from the date of invoice and if payment of any invoice for lamps is made within ten (10) days from date of same, two percent (2%) may be deducted from the amount of such invoice.

(c) No samples may be supplied free of charge.

(d) No guarantees may be given except in accordance with the specifications shown in the Schedules, but the manufacturer may make such allowances or replacements for short life lamps as will give the purchaser the listed nominal average life for each lamp.

(e) In any sale of or quotation on lamps in combination with any other material, equipment or lamps other than high intensity mercury vapor lamps listed on the Schedules, it shall be clearly and specifically set forth that the parties to whom the sale or quotation is made shall be free to accept the price named on the lamps or the price named on the other material, equipment or other lamps, each independently of the acceptance or rejection of the other.

(f) No allowance may be made for burned out lamps, or bases, or other material, directly or indirectly, as part payment for or as a condition of the sale of lamps covered by the Schedules.

(g) No allowance may be given nor payment made to cover the cost of inspecting or testing lamps, except that factory facilities may be given without charge for the purpose of initial inspection or test, but not for life test.

(h) Bids or quotations may be made at schedule prices when the specifications given in the established schedules are used and made as part of the bid or contract without any modification, but when different specifications of any nature are required, bids or quotations may not be made until request for authorization to bid or quote on such special specifications has been made of the Supervisor and until the Supervisor has sent authorization to bid simultaneously to both manufacturers. This same rule will also apply to bids and quotations requiring terms and conditions of sale different than those set forth herein.

(i) Sales of lamps may be made to the United States Government for its own requirements at the lowest net price provided in the Schedules, with transportation allowed.

(j) Domestic territory shall be considered to be the United States, its territories and dependencies including Alaska, Hawaiian Islands, the Panama Canal Zone, Puerto Rico, and the Virgin Islands, but not the Philippines, which, with the rest of the world, shall be regarded as foreign territory.

(k) All lamps listed in the Price Schedule of High Intensity Mercury Vapor lamps will be sold and billed to purchasers f.o.b. point of shipment, with transportation (excluding cartage) allowed to all points in domestic territory.

. High Intensity Mercury Vapor lamps may be sold directly y the manufacturer or through jobbers holding Form B agency ppointments for the distribution and sale of large MAZDA amps with such a manufacturer. In the latter case the xisting Form B agency appointment with the manufacturer will e amended by a rider which will permit such Form B agent to lso sell high intensity mercury vapor lamps in accordance with the general terms and conditions of its Form B agency ppointment, except that -

(a) The basic rate of compensation of the agent shall be 32% of list with an additional 5% of net for prompt report and payment.

(b) The authority of the agent shall be limited to selling lamps to consumers in accordance with the terms, conditions and discounts outlined in section 1. above.

(c) Initially and until further notice no high intensity mercury vapor lamps may be consigned to the agent, and all shipments shall be made by the manufacturer directly to purchasers served by the agents. While this provision is in force there will be no shipment charge made by the manufacturer to the agent for making such direct shipments. This provision will not prohibit shipments to the agent of such lamps as it requires for demonstration purposes in fixtures which it has purchased, but the agent in such cases will be required to immediately take such lamps from the manufacturer's consigned stock in its possession and install same in its demonstration apparatus and immediately report same as sold and promptly remit for same.

(d) Agents may not be authorized to sell or re-consign lamps to dealers.

(e) All riders authorizing Form B agents of the manufacturers to sell high intensity mercury vapor lamps in accordance with this plan, must be recorded with the Supervisor and approval issued prior to making same effective.

ADJUSTMENTS ON HIGH INTENSITY MERCURY VAPOR LAMPS

To facilitate the replacement of broken and defective lamps and to make the necessary credit allowance on such lamps, it has been decided that a stock, to be used only for replacement purposes, may be maintained in sales warehouses for servicing the territory in which an installation has been sold. No more than six lamps of any particular type may be placed in a sales warehouse for this purpose.

As soon as a failure has been reported, immediate steps shall be taken to replace the individual lamp from the stock in the sales warehouse maintained for that purpose. The customer shall place an order for the replacement lamp and shall be billed for same in the regular manner.

It shall be especially noted that if the installation was made and billed by the Westinghouse Electric & Manufacturing Company, the charge for the replacement lamp shall be rendered to that organization who, in turn, will handle it with their customer.

The Westinghouse Lamp Company representative, to whom a complaint has been made, shall advise the customer immediately of the adjustment to be allowed. Obviously, the salesman will have to take the word of the customer as to the length of time the lamp was in service before failure. For any lamp that failed up to about one-third of its rated life, full adjustment shall be made. On lamps that have been in service for a period of time greater than about one-third of the rated life, the adjustment shall be made on a proportionate basis.

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EXAMPLE: A 1500 hour life lamp which failed after 750 hours of service would be entitled to an adjustment of one-half the amount billed the customer for the lamp originally. In making this adjustment the salesman shall use Memo of Adjustment Form S-183, indicating the number of lamps involved in the adjustment in the first column and then using the rest of this form to write the history of the failure and the amount of the adjustment. This form shall then be distributed as shown on the bottom of the first copy of the form.

The broken or defective lamp shall be returned immediately to the Commercial Engineering Department at Bloomfield. This return shall be covered with a letter addressed to Mr. A. B. McKenna, Commercial Engineering Department. This letter shall be an advice of the return, a statement of the use to which the lamp has been put and the number of hours it has been operated, the adjustment allowed and an explanation of the cause or circumstance under which it failed.

The Commercial Engineering Department shall communicate with the Division Office if there is any question about the adjustment, or if they find after inspection that the returned lamp was apparently in service for a greater length of time than claimed by the customer.

The Sales Division in rendering credit will indicate that the offsetting charge is to be to Account #322.1, Allowances - Large Mazda Lamps.

HIGH INTENSITY MERCURY LIGHTING

estinghouse High Intensity Mercury Li ting Equipment provides many disti t advantages. Chief among these ar (1) The lumen output of this lamp is pproximately 2½ times that obta ed from incandescent lamps, (2) P ent levels of illumination can be m erially increased without rewiring ar without any increase in wattage, (3) The distinctive color from the lamp assures greater visual acuity, and (4) Increased lamp life.

In industrial applications, Westinghouse High Intensity Mercury equipment is ideal for the general lighting of foundries, assembly lines, machine shops, inspection departments and similar spaces because of its high efficiency.

Westinghouse alone offers complete 400-watt and 250-watt High Intensity Mercury lighting equipment, consisting of Ballast Equipment, lamps, and reflectors. For special applications and for floodlighting, Westinghouse maintains layout and planning facilities that are available on request.

DESIGNING THE INSTALLATION

ollowing is a method for designing H 1 Intensity Mercury industrial lighti installations.

he procedure is divided into five st s:

Decide the footcandle illumination required. Refer to Table I.

Select the type of lighting unit best adapted to the location and the activity to be performed. See pages 6 through 27.

Decide the Conditions Factor. Refer to Table III for rating.

From the Table on the opposite page of the selected unit, determine the required spacing of the units to produce the desired illumination.

Check capacity of wiring. (Page 2).

1. eciding the Footcandle Illumina- ion Required

he footcandle values shown in Table I are sufficient not only to provide proper intensities for the work to be performed but have the additional purpose of preventing eyestrain and conserving vision. The values have been assigned on the basis of engineering experience and assume the average conditions found in practice. Where especially close attention to fine detail is required, more illumination is needed than where the process is essentially automatic or operated on a coarser scale.

2. Selecting the Type of Lighting Unit

There is a wide range of industrial units available for the special size and shape of the 400-watt and 250-watt High Intensity Mercury lamps. These units and their particular applications are illustrated and described in detail in following pages of this Catalog Section.

3. Determining the Conditions Factor

A room must be appraised first from the standpoint of its general proportions; second, from the color and the material of the walls and ceiling; and third, from the standpoint of its situation, whether it is located where dust, dirt, soot, smoke, or other similar elements are present which would tend to collect on, or in, the lighting units and thereby reduce efficiency. A simple table, Table III, has been prepared which gives a general summary of these conditions, and should be used to determine the Conditions Factor.

Note first of all the general proportions of the room, whether its width is approximately equal to or is twice, three or four times the ceiling height.

The illumination in any room is dependent upon the amount of light reflected from the walls and ceiling. White walls reflect more light than gray walls—

DESIGNING THE INSTALLATION—Continued

TABLE I

ILLUMINATION REQUIRED AT THE WORK

	Foot-candles
Where Discrimination of Detail is not Essential............... Handling material of a coarse nature; grinding clay products; rough sorting; coal and ash handling; foundry charging.	5
Where Slight Discrimination of Detail is Essential............. Rough machining; rough assembling; rough bench work; rough forging; grain milling.	10
Where Moderate Discrimination of Detail is Essential........... Medium bench and machine work; fine molding and core making; newspaper printing.	20
Where Close Discrimination of Detail is Essential.............. Tool making; weaving; stitching and trimming.	30
Where Very Close Discrimination of Detail is Essential........... Electrotyping; glass cutting; polishing and inspecting.	50
Where Discrimination of Minute Detail is Essential............ Fine bench and machine work; fine inspecting; typesetting engraving.	100

gray walls reflect more light than black walls. Therefore, in appraising the color of the walls and ceiling three general classifications are used: light, medium, dark.

The third and final step is to decide whether or not the air is clean or subject to dusty, sooty or smoky conditions. This third consideration is referred to as a maintenance condition in that it has to do with the maintenance of the lighting unit. There is no definite table or guide to go by in selecting this condition except observation. This condition is classified as either Very Good or Fair.

By referring to Table III, with the room proportions, the classification of Light, Medium or Dark for color of the walls and ceiling, and Very Good or Fair for maintenance, the Conditions Factor can be easily determined. This factor is not a numerical one, but is given in terms of "Favorable", "Average" and "Unfavorable."

4. Decide Mounting Height and Spacing

The first step is to determine the proper location of outlets to obtain evenly distributed illumination over the room. The allowable spacing between outlets is dependent upon the mounting height of the units. The mounting height is the distance from the floor to the bottom of the reflector. Spacing between units should be approximately equal to the mounting height and in no case should the spacing be more than $1\frac{1}{2}$ times the mounting height. The distance from the wall to the first row of outlets should be approximately one-half the distance between units.

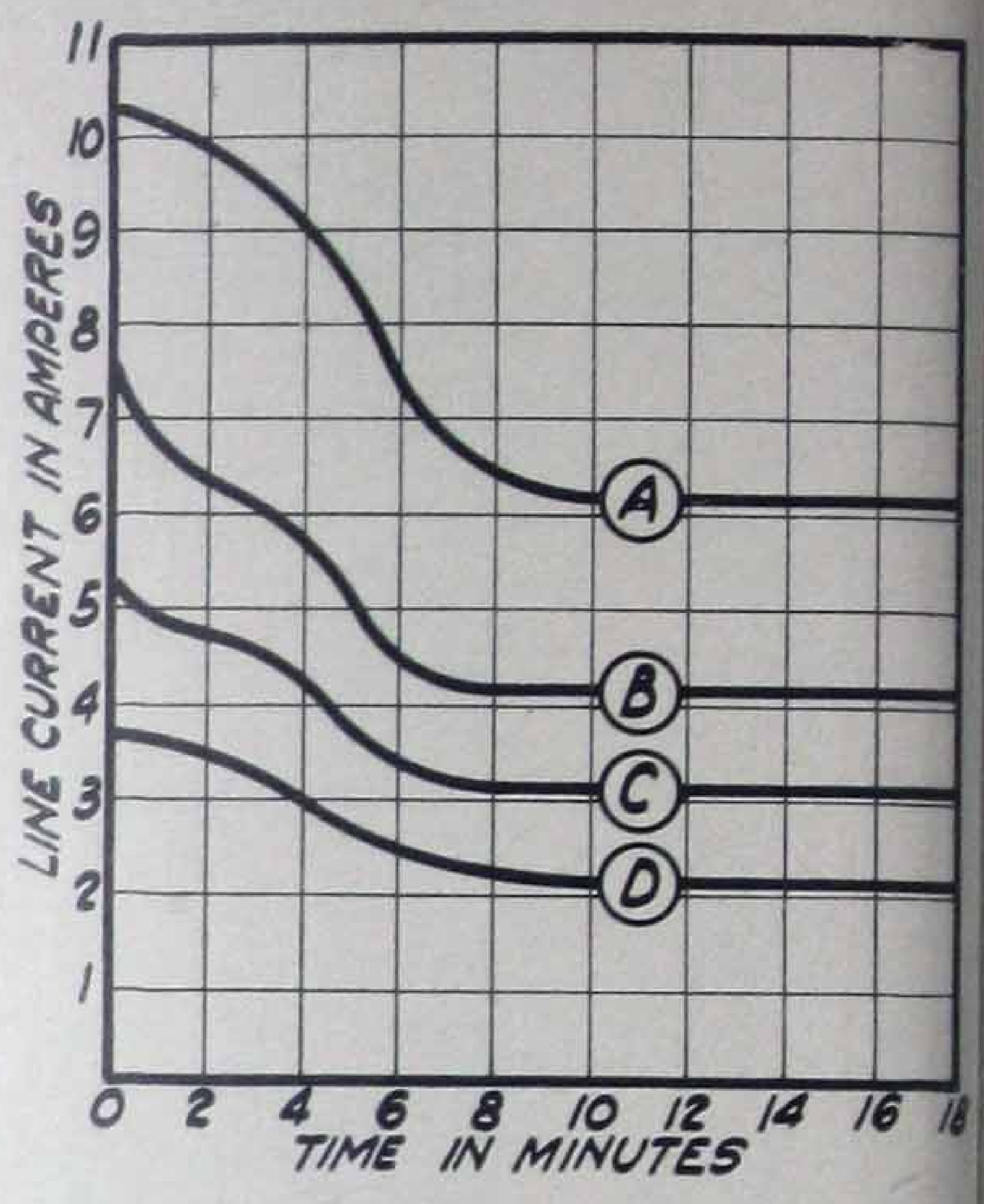
After the outlets have been located and the total number determined the "Area per outlet" is found by dividing the total floor area by the number of outlets.

$$\text{Area per Outlet} = \frac{\text{Total Area}}{\text{Number of Outlets}}$$

Locate the above figure in the column marked "Area per Outlet" in the table for the selected unit. In the column marked "Conditions Factor" select the factor previously determined (Favorable, Average or Unfavorable). Following horizontally to the right on this line the illumination in footcandles which will be provided will be found in the "Average Footcandles" column.

5. Check Capacity of Wiring

Excessive voltage drops in wiring should be avoided because they represent power losses. Wire which may be of sufficient size to pass the Underwriter's requirements and quite safe from the standpoint of fire hazard may not be adequate to avoid an excessive voltage drop. Because the wattage input to the lamp must be closely limited, transformers and reactors are equipped with several line taps to meet all common service voltages. The nearest tap to available line voltage should always be used.



Curve A—Transformer—115 V. No PF Correction

Curve B—Transformer—115 V. With PF Correction

Curve C—Reactor—220 V. No PF Correction

Curve D—Reactor—220 V. With PF Correction

The above Chart indicates graphically the line current characteristics of the 400-watt mercury reactors and transformers during the period in which the lamp is coming up to full normal operation. Note the difference in line current on 115-volt and 220-volt lines, with and without power factor correction. The lamp requires 10 or 12 minutes to reach a stable operating condition.

The starting and operating voltage of the 250-watt mercury lamp are consid-

TABLE II

PER CENT LIGHT REFLECTED FROM TYPICAL WALLS AND CEILINGS

Surface	Class	Color	Light Reflected Per Cent
Paint Paint Paint Caen Stone	Light	White Ivory Cream Cream	81 79 74 69
Paint Paint Paint Caen Stone	Medium	Buff Light Green Light Gray Gray	63 63 58 56
Paint Paint Paint Paint Paint Paint Cement Brick	Dark	Tan Dark Gray Olive Green Light Oak Dark Oak Mahogany Natural Red	48 26 17 32 13 8 25 13

DESIGNING THE INSTALLATION—Continued

bly lower than for 400-watt lamp, and ause of low power factor a reactor is recommended in series when service vides 220 to 240-volt range. Trans-ners with proper secondary voltage , therefore, used for 220 to 240-volt ge of service, 190 to 208-volt range of vice, and 107 to 123-volt range of ser-e. If no condenser is provided to rect the power factor, the starting current for 115-volt systems is ap-ximately 7.25 amperes and the oper-ng current is 5.65 amperes per unit. he power factor is corrected the start- line current is approximately 3.0 peres and the operating current is 5 amperes per unit.

or 230-volt systems the above cur-t values for 250-watt units is reduced 50%.

he above line currents for Transform- are for definite taps indicated. For er line taps of transformers the line rent varies inversely as the voltage. e latter also applies for starting cur-t of Reactors, or Reactor-Capacitors.

Example

t is desired to illuminate a machine p in which rough machine work is e. The ceiling height is 13 feet. The ling and walls are light in color and the intenance is very good. The size of room is 30 feet wide and 45 feet long.

Solution

Decide the illumination required. ferring to Table I under Machine ops it will be found that 10 footcandles required for rough machine work.

Select the lighting unit. The ceiling ght is 13 feet so the units must be unted lower than 20 feet. The 250-tt Glassteel Diffuser is selected be-use of the mounting height and because maximum diffusion is desired. The units should be mounted as high above the floor as possible to reduce glare and give a more uniform light distribution.

3. Decide the conditions factor. The width of the room is approximately twice the ceiling height. The ceiling and walls are light and the maintenance is very good. Using this data and referring to Table III the conditions factor is found to be "Favorable."

4. Determine spacing of lighting units. Refer to the 250-watt Glassteel Diffuser Table, page 13. In column headed "Average Footcandles" it is found that with a conditions factor of "Favorable", 11-14 footcandles will be provided with a spacing of 14¾ x 14¾ feet. The spacings therefore should be 14 or 15 feet. This spacing will be satisfactory as far as distributing the light uniformly is concerned since it is less than one and a half times the mounting height.

Draw a simple floor plan of the room to scale and on it lay out the units symmetrically, using a spacing of 14 or 15 feet. Make the distance from the wall to each unit approximately one half the distance between units. Six units on 15 by 15 feet spacings will be required.

EXAMPLE

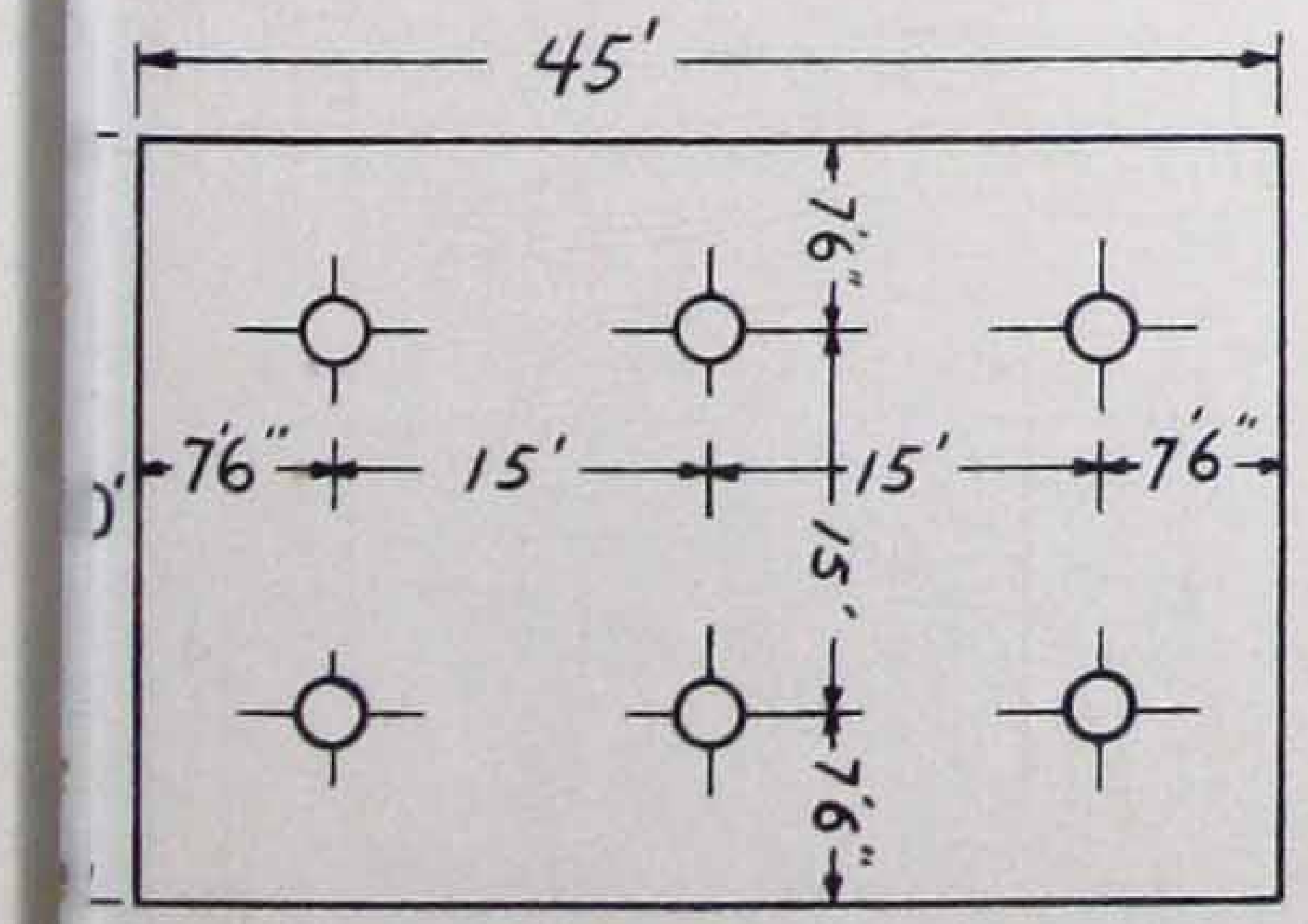


TABLE III

CONDITIONS FACTORS			
Proportions of Room	Color of Ceiling and Sidewalls	MAINTENANCE OF EQUIPMENT	
		Very Good	Fair
Width Approximately Four or More Times Ceiling Height	Light	Favorable	Favorable
	Medium	Favorable	Favorable
	Dark	Favorable	Average
Width Approximately Twice Ceiling Height	Light	Favorable	Average
	Medium	Favorable	Average
	Dark	Average	Unfavorable
Width Approximately Equal to Ceiling Height	Light	Average	Unfavorable
	Medium	Unfavorable	Unfavorable
	Dark	Unfavorable	Unfavorable

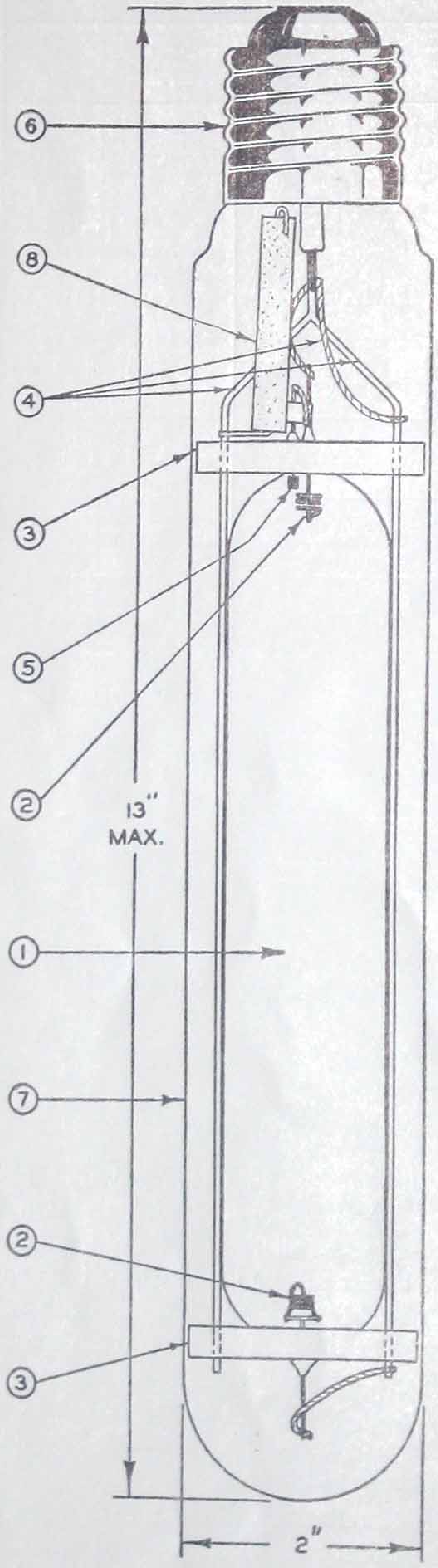
High Intensity Mercury Superimposed on Incandescents

Where poor voltage regulation prevails, or where color discrimination is necessary, auxiliary circuits of incandescent lamps can be installed, or the combination mercury and incandescent unit should be used. These circuits, or combination units, serve in an emergency and also provide the necessary color correction to the High Intensity Mercury Vapor installation.

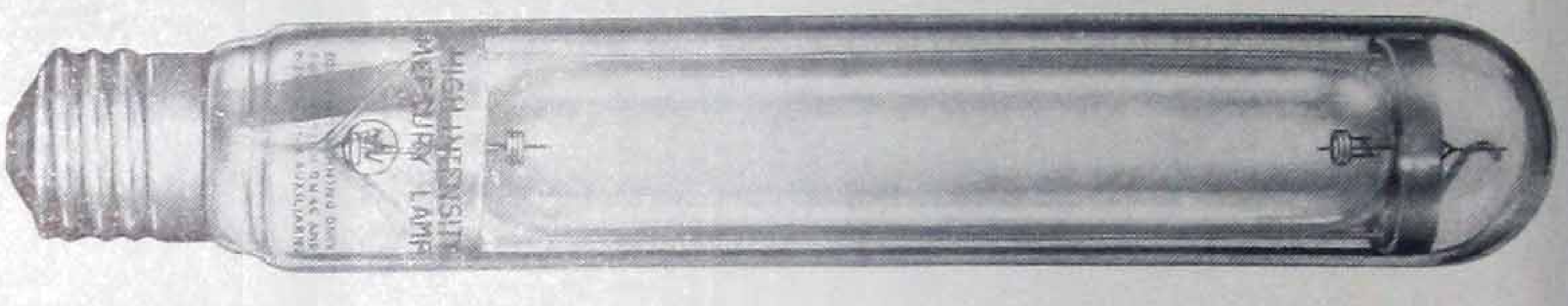
In installations which utilize individual mercury and incandescent units, it is most desirable to alternate incandescent with the Mercury Vapor fixtures. In a room where there are three rows of units, the center row should be Mercury Vapor units and the outside rows should be incandescent units of a wattage depending on the color correction desired. Where an incandescent unit is located in each of the four corners of a room or bay, the Mercury Vapor unit is usually installed in the center.

400-WATT HIGH INTENSITY MERCURY VAPOR LAMP

TYPE H-1



1—ARC TUBE
2—ELECTRODES
3—SUPPORTING BANDS
4—LEAD AND SUPPORT WIRES
5—STARTING ELECTRODE
6—MOGUL SCREW BASE
7—OUTER TUBE
8—RESISTOR



The 400-watt Westinghouse High Intensity Mercury Vapor lamp has an efficiency of approximately 40 lumens per watt. The lamp is 13″ long, 2″ in diameter, produces 16,000 lumens of light and consumes 400 watts.

The lamp consists of two tubular bulbs, one within the other. The inner bulb, wherein the arc is formed, is approximately 7″ long and $1\frac{3}{8}$″ diameter and this tube is the real light source.

The lamp requires approximately 20 volts, 5 amperes for a period of 2 minutes after the arc is established. After 10 or 12 minutes, the normal operating condition is reached when the lamp requires approximately 150 volts, 2.9 amperes.

Burning Position

In order that the arc stream may be maintained in the center of the tube the lamp must be operated in a vertic position. A deviation greater than 1 degrees from the vertical will cause th arc stream to bow until it touches th wall of the tube which will soon me and destroy the lamp.

ESSENTIAL DATA

Bulb	Tipless T-16
Base	*401 Mogul Screw
Max. Overall Length	13 Inches
Watts	400 ± 10%
Lumens	16,000
*Lumens per Watt	40 ± 10%
Average Life	2000 Hours
Frequency	60 Cycles
Light Center Length	7¾ Inches
†Burning Position	Base Up
Finish	Clear

* When tested in series with an accepted reactor or across an accepted transformer with the line voltage corresponding to the tap used.

† Lamps for base down burning position may be had on request.

Current Interruption

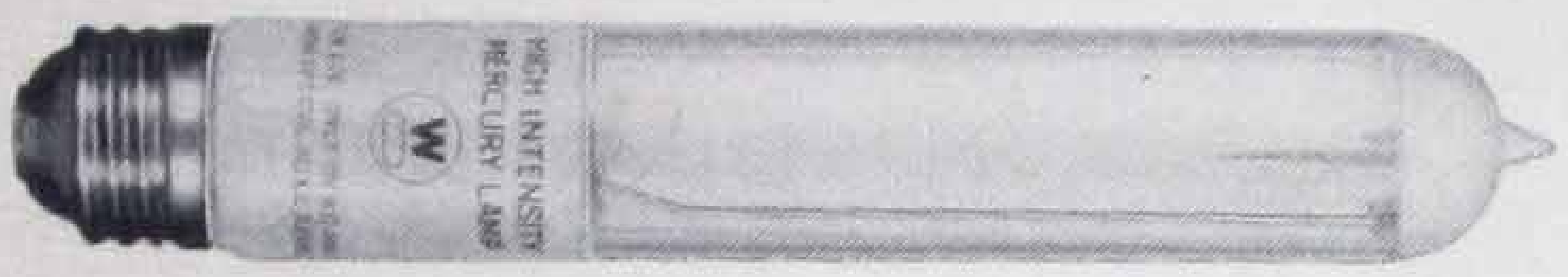
Should an interruption in the ele tric service take place while the lam is in operation, the arc will be quenche and cannot be re-established until th lamp has cooled sufficiently to reduc the mercury vapor pressure to a poin where arc is re-established. The coolin time required is approximately 5 min utes—but will vary with conditions.

Quality and Color—Visual Acuity

The light produced by the High In tensity Mercury Vapor lamp is mad up mainly of wave lengths in the violet green and yellow green portion of th visible spectrum. Most of the ligh produced, however, is radiated in th yellow green and green parts of th visible spectrum, near the eye's peak of sensitivity.

Objects of colors other than violet green and yellow green, when lighte with High Intensity Mercury Vapo lamps, do not appear normal to the eye Due to the lack of red wave lengths red objects or those containing red wil appear most distorted. A sufficient amount of incandescent light, rich in red may be added where color discriminatio is necessary.

250-WATT HIGH INTENSITY MERCURY VAPOR LAMP
TYPE H-2



he 250-watt Westinghouse High ensity Mercury Vapor Lamp has efficiency of approximately 30 ens per watt. The lamp is 8″ long, ″ in diameter, produces approxi- tely 7,500 lumens of light and con- es 250 watts.

he 250-watt lamp consists of a single e with a 5″ light center, and is ipped with a medium screw base. requires approximately 20 volts, 5 peres for a period of 2 minutes er the arc is established.

fter 10 or 12 minutes, the normal rating condition is reached when lamp requires approximately 70 ts, 3.9 amperes.

rning Position

nlike the 400-watt size, the 250- tt High Intensity Mercury lamp can operated in any burning position.

rrent Interruption

he 250-watt lamp will not im- diately relight when extinguished by momentary interruption of current. e lamp must cool sufficiently to re- e the mercury vapor pressure to a nt where the arc is re-established. e time required for starting will vary m 3 to 5 minutes.

Enclosing Equipment

Because the 250-watt lamp is a single tube device, it is more susceptible to cooling effects of moving air. To insure maximum light output it is therefore recommended the lamp be operated in enclosing equipment to protect it from drafts.

Color and Quality—Visual Acuity

The color of the light produced by the 250-watt lamp is practically the same as that produced by the 400-watt size, except that it is slightly less yellow.

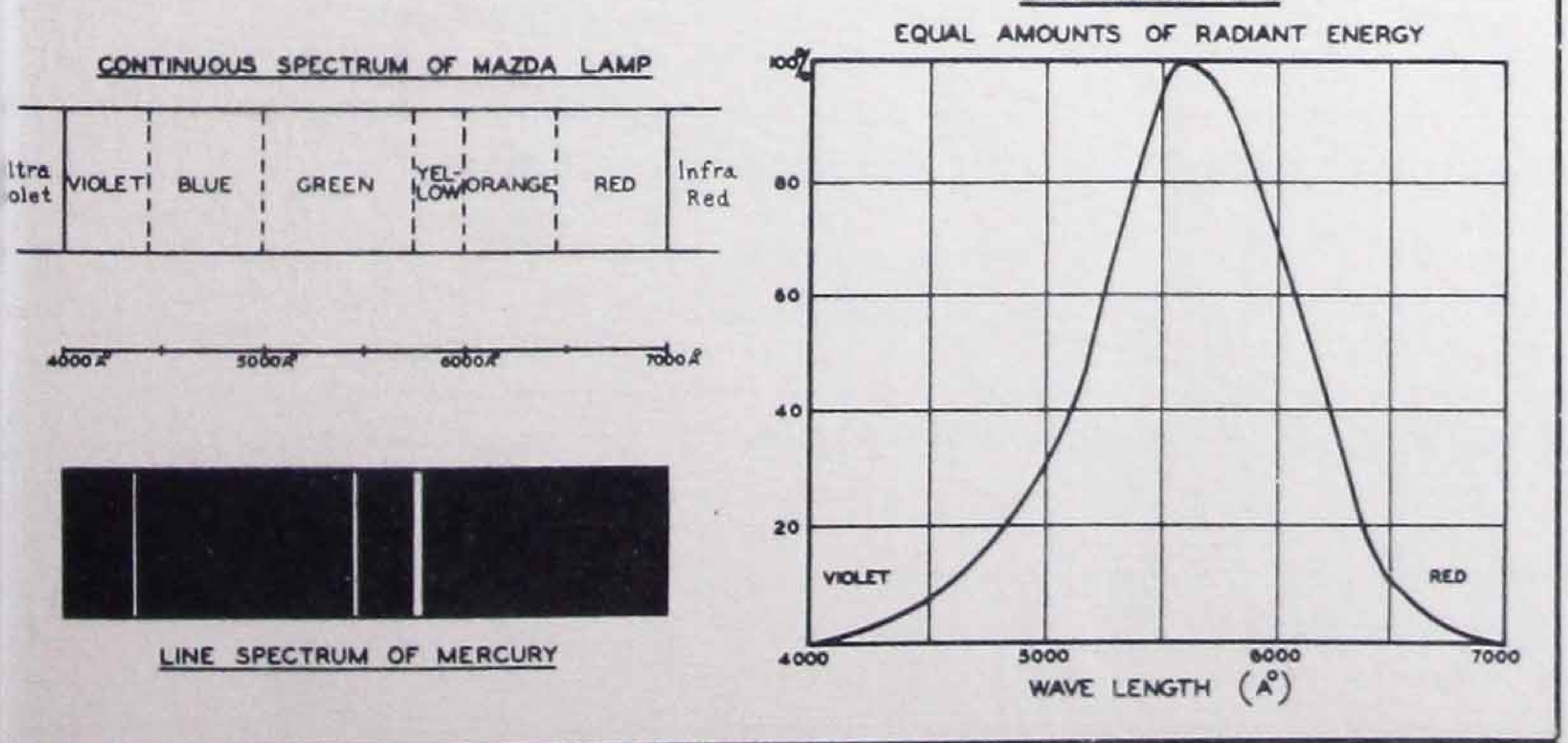
Where a fair approximation of daylight color is desirable, the 250-watt lamp will also combine equally well with light of the incandescent lamps.

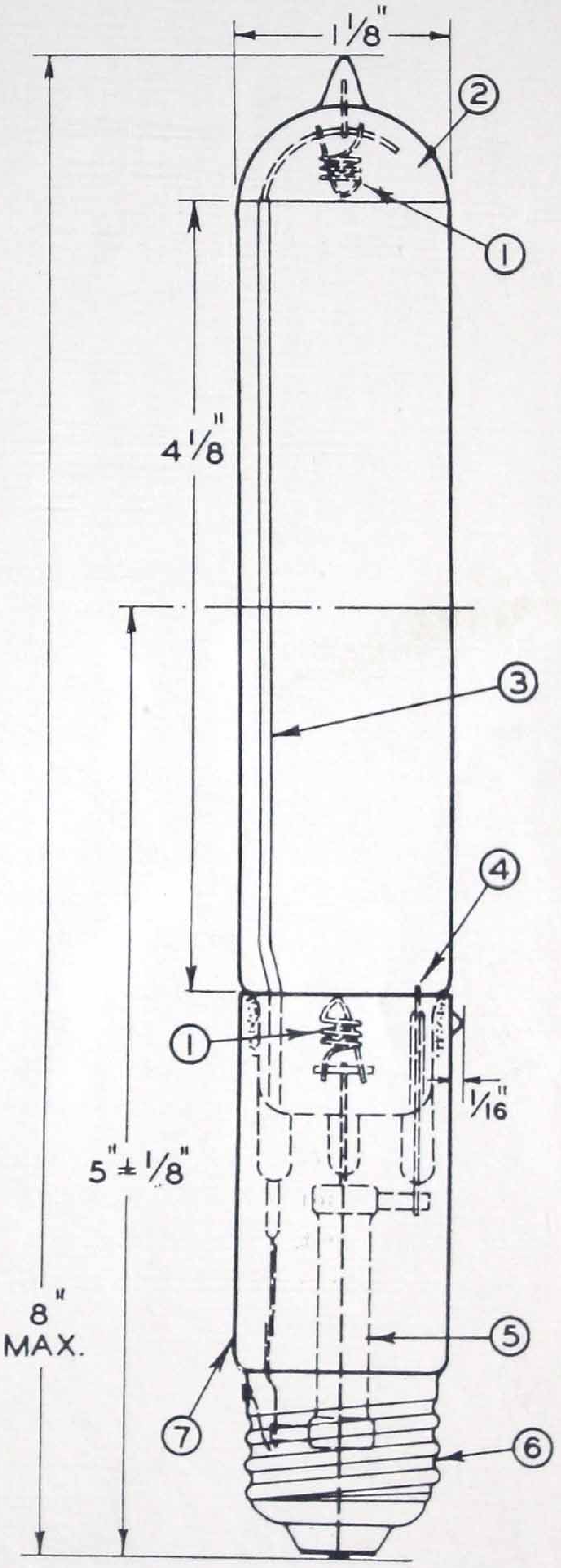
ESSENTIAL DATA

Bulb	T9 Tipped
Base	Medium Screw
Max. Overall Length	8 Inches
Watts	250 ±10%
Lumens	7,500
*Lumens per Watt	30 Initial ±10%
Average Life	2000 Hours
Frequency	60 Cycle
Light Center Length	5 Inches
Burning Position	Any
Finish	Clear, Coated End

*When operated in conjunction with an accepted transformer with the line voltage corresponding to the tap used.

SPECTRUM AND EYE SENSITIVITY CHART FOR 400- AND 250-WATT MERCURY LAMPS





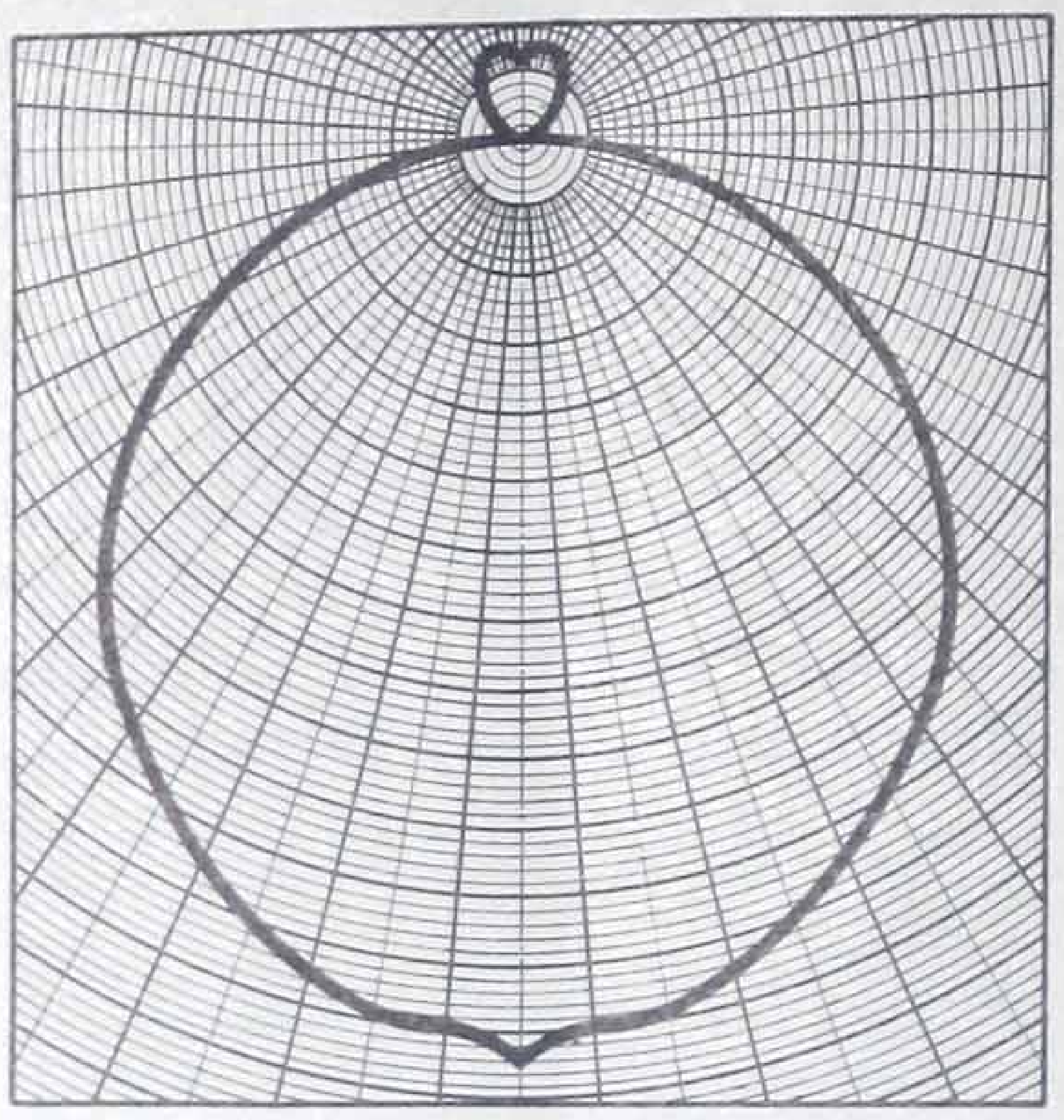
1—ELECTRODES
2—PLATINIZED END
3—GLASS ENCASED LEAD WIRE
4—STARTING ELECTRODE
5—STARTING ELECTRODE RESISTOR
6—MEDIUM SCREW BASE
7—OPAQUE GLASS EXTENSION

HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

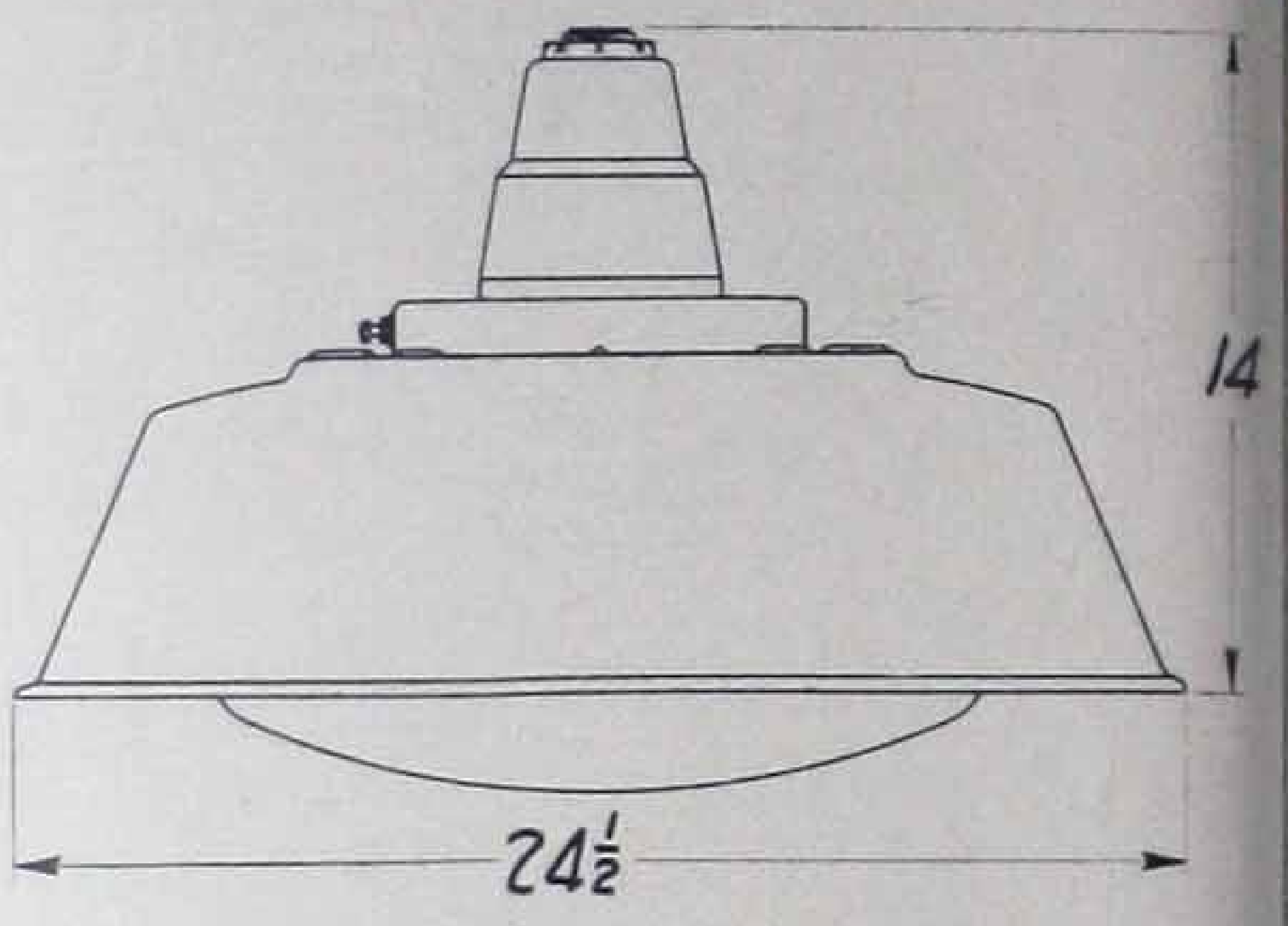
400-WATT GLASSTEEL DIFFUSER

FOR LOW MOUNTING

400-Watt Glassteel Diffuser, Reflector and Globe



Vertical Distribution with 400-Watt Glassteel Diffuser



Dimensions in Inches Glassteel Diffuser

The Westinghouse Glassteel Diffuser is designed to properly distribute the light from the 400-watt High Intensity Mercury lamp where the mounting height is under 18 feet. For mounting heights of 18 feet and over, the Westinghouse High, Medium and Low mounting aluminum reflectors, as described, should be used.

The Glassteel Diffuser consists of a white porcelain enameled reflector which directs the light downward, and a diffusing glass globe. The reflector has six openings at the top which permit some light to reach the ceiling, thus reducing the contrast between the ceiling and lighting unit. The diffusing glass globe conceals the bright light source, thereby minimizing glare and softening shadows.

The High Intensity Glassteel Diffuser is especially suitable for lighting machine shops, plating and polishing rooms, assembly lines and departments, pattern shops, printing plants, tool rooms, stamping departments, finishing and inspection departments and welding forge and heat treating rooms.

Construction

High Intensity Glassteel Diffuser reflector is drawn from 22 gauge iron sheet and finished with one ground coat and two white coats of porcelain enamel inside and outside.

The diffusing globe is of single layer homogeneous glass and is equipped with a copper globe protecting ring. It is supported in the reflector by two bayonet pins and two brass set screws with lock nuts.

The Mogul type skeleton socket with high heat wax and nickel-plated interior is held in place by a cast brass adapter which is locked to the reflector by means of a special cast aluminum cap.

Accessories

Since the 400-watt High Intensity Mercury lamp will not operate on ordinary lighting circuits, it is necessary to provide suitable ballast equipment as described and listed on page 28.

To provide greater flexibility and ease of maintenance between the fixture and the accessories, the Westinghouse Safe-Change Hanger is recommended

Mercury Lamp Size in Watts	Diameter Inches	Depth Inches	Standard Package Quantity	Standard Package Weight	Style No. *† for ½-inch Conduit	List Price
GLASSTEEL DIFFUSER COMPLETE WITH SOCKET AND GLOBE						
400	24	16	2	65	785 650	$18 50
GLASSTEEL DIFFUSER REFLECTOR AND SOCKET ONLY						
400	24	14	2	50	789 584	11 25
GLASSTEEL DIFFUSER GLOBE ONLY						
400	16	10	2	15	888 335	7 25

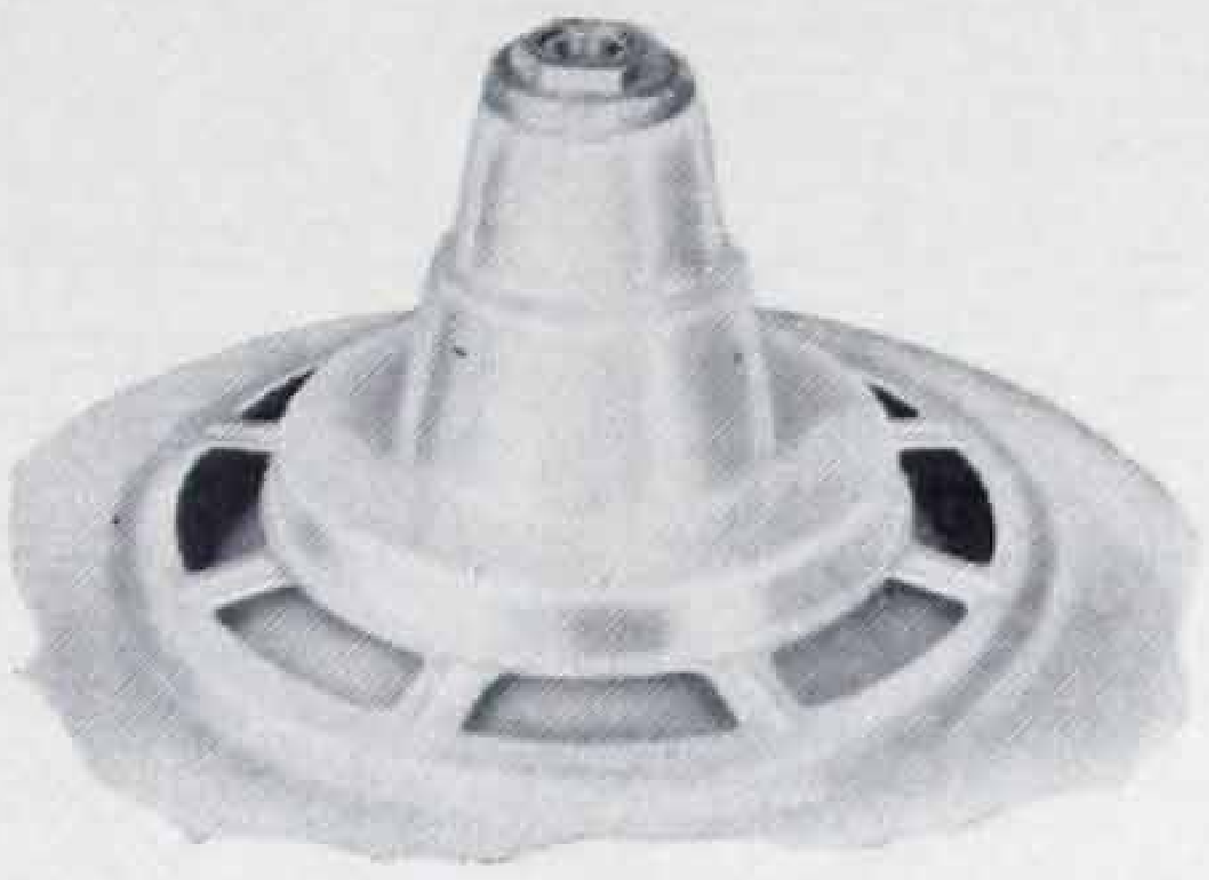
* Style numbers do not include lamps—refer to Westinghouse Lamp Company or its agents.

† ¾-inch can be furnished when specified.

See pages 28 through 32 for ballast and accessory equipment.

HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

400-WATT GLASSTEEL DIFFUSER FOR LOW MOUNTING



Conduit Mounting
One Piece Reflector

Distance from Underside of Reflector to Floor to be Not less than (Feet)	Approximate Spacing (Feet)	Area per Outlet (Sq. Ft.)	Conditions Factor	Average Footcandles 400-Watt
10	11 x 11	110–125	Favorable Average Unfavorable	44–55 33–44 27–34
10½	11½ x 11½	125–145	Favorable Average Unfavorable	37–50 30–37 23–30
11½	12½ x 12½	145–170	Favorable Average Unfavorable	34–43 26–34 21–26
11½	13½ x 13½	170–200	Favorable Average Unfavorable	30–37 21–30 17–21
12½	14¾ x 14¾	200–230	Favorable Average Unfavorable	24–31 18–24 14–18
13	15½ x 15½	230–260	Favorable Average Unfavorable	21–28 17–21 13–17
13½	16¾ x 16¾	260–300	Favorable Average Unfavorable	20–24 14–20 11–14
14½	18 x 18	300–340	Favorable Average Unfavorable	17–20 13–17 10–13
15½	19 x 19	340–390	Favorable Average Unfavorable	14–18 11–14 9–11
16½	20½ x 20½	390–440	Favorable Average Unfavorable	13–17 10–13 7.5–10
17	21¾ x 21¾	440–500	Favorable Average Unfavorable	10–13 7.5–10 6.5–7.5

HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

400-WATT ALUMINUM REFLECTORS

FOR LOW, MEDIUM AND HIGH MOUNTING

400-Watt Aluminum Reflector

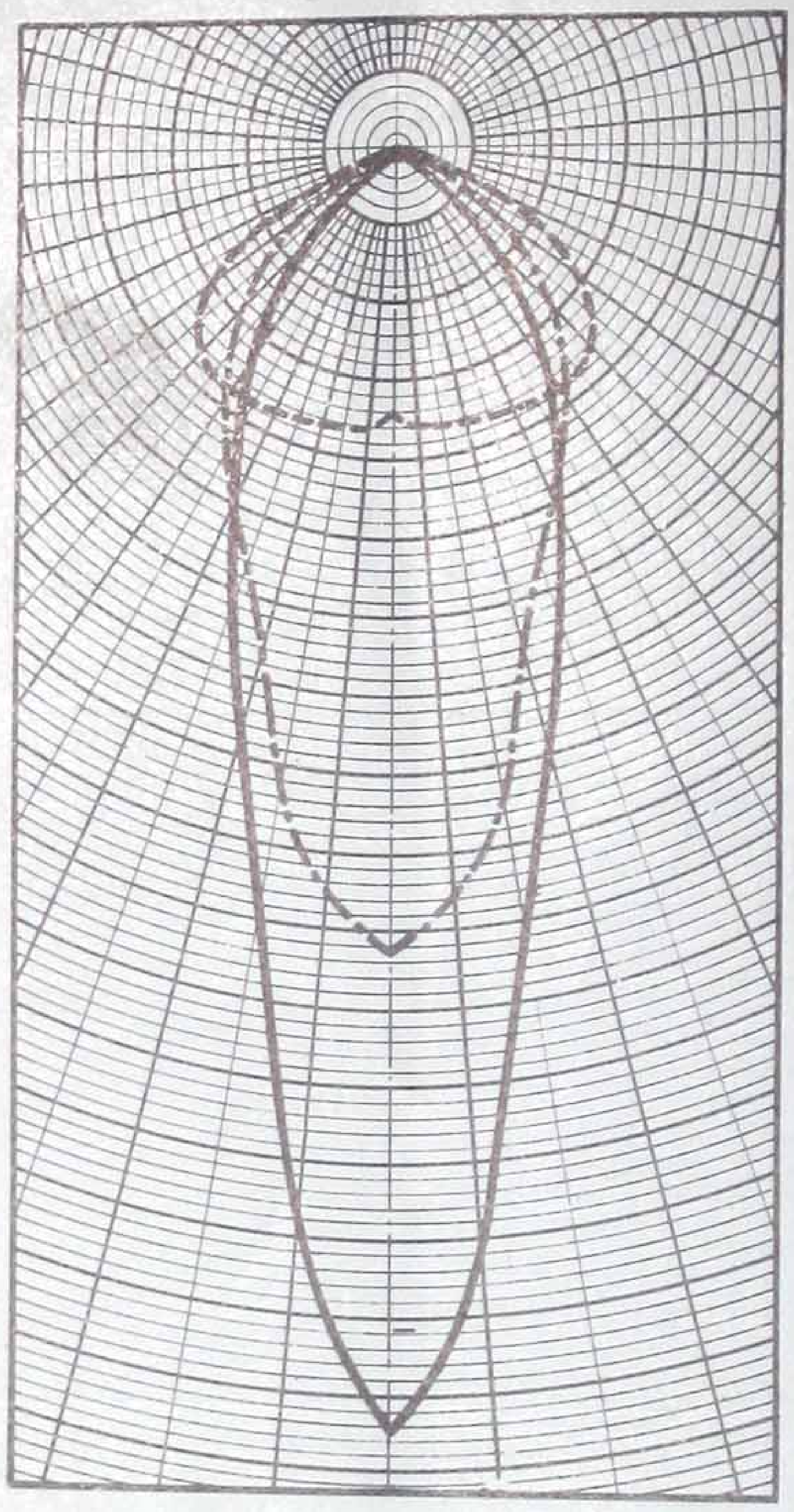
Westinghouse aluminum reflectors are designed to properly distribute light from the 400-watt High Intensity Mercury lamp where the mounting height is 18 feet and over.

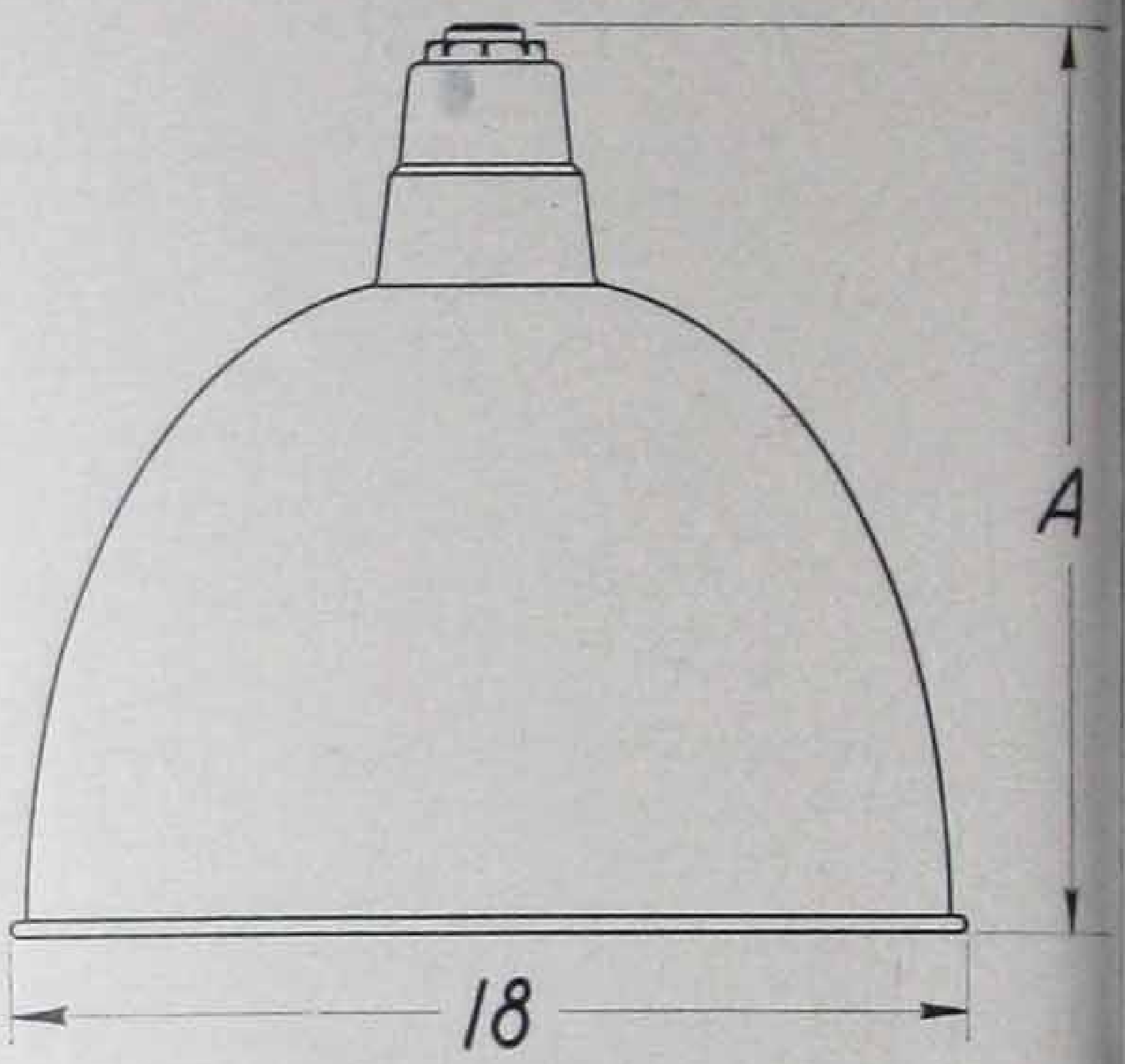
These units are particularly suited for the general lighting of foundries, machine shops, stamping departments, power plants, receiving and shipping departments and sheet metal departments.

Construction

The high mounting reflectors are made from 14 gauge commercially pure aluminum sheet. Their shape is such as to make them especially strong and durable after fabrication.

The special Mogul type socket is rigidly mounted in the hood to properly position the lamp in the reflector. Various types of hoods are available for mounting as listed below. Complete descriptions of the applicable hoods will be found in catalog sections 61-140 and 61-153.


Vertical Distribution with 400-Watt Aluminum Reflectors at 25, 35 and 50 Feet Mounting Heights



Dimensions in Inches

Description	Dim. A
Low Mounting...........	17⅛″
Medium Mounting........	18⅛″
High Mounting...........	18⅝″

The entire reflector is finished by the Alzak process for greater permanence and ease of cleaning.

Accessories

Since the 400-watt High Intensity Mercury lamp will not operate on ordinary lighting circuits, it is necessary to provide suitable ballast equipment as described and listed on page 28.

To provide greater flexibility and ease of maintenance between the fixture and the accessories, the Westinghouse Safe-Change hanger is recommended.

Glass covers are recommended. Order separately as listed below.

Description	Mounting Height in Feet	Mercury Lamp Size in Watts	Diam. Inches	Depth Inches	—Standard Package— Quantity	Weight	—½-Inch Conduit— Style No.*†‡	List Price	—4-Inch Outlet Box— Style No.*†	List Price
ONE-PIECE ALUMINUM REFLECTORS COMPLETE WITH SOCKET										
Low Mounting	18 to 25	400	18	17⅛	4	30	789 585	$16 50	....	......
Medium Mounting	26 to 35	400	18	18⅛	4	30	789 587	16 50	....	......
High Mounting	36 and over	400	18	18⅝	4	30	789 588	16 50	....	......
WEMCO QUICK-CHANGE ALUMINUM REFLECTORS COMPLETE WITH HOOD										
Low Mounting	18 to 25	400	18	17⅛	4	30	890 059	16 90	890 062	$16 90
Medium Mounting	26 to 35	400	18	18⅛	4	30	890 060	16 90	890 063	16 90
High Mounting	36 and over	400	18	18⅝	4	30	890 061	16 90	890 064	16 90
ALUMINUM WEMCO QUICK-CHANGE REFLECTORS ONLY										
Low Mounting	18 to 25	400	18	15¼	4	26	888 779	16 10	888 779	16 10
Medium Mounting	26 to 35	400	18	16¼	4	26	888 780	16 10	888 780	16 10
High Mounting	36 and over	400	18	16¾	4	26	888 781	16 10	888 781	16 10
WEMCO QUICK-CHANGE HOODS ONLY										
....	....	400	..	1⅞	10	10	347 919	80	347 920	80
HINGED CLEAR GLASS COVER ONLY										
....	....	400	18	....	4	20	341 067	4 10	341 067	4 10
SNAP CLEAR GLASS COVER ONLY										
....	....	400	18	....	4	20	890 036	4 10	890 036	4 10
CLEAR GLASS LENS ONLY										
....	....	400	18	....	4	16	341 070	1 80	341 070	1 80

* Style numbers do not include lamps—refer to Westinghouse Lamp Company or its agents.

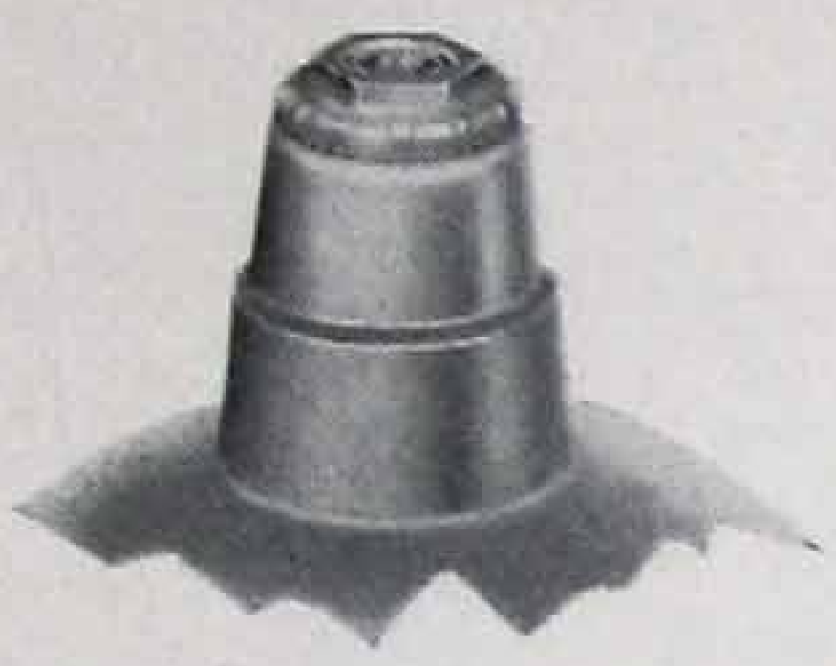
† **Important Notice:** For steel mill service where acid conditions are encountered, glass covers, described on page 28, must be used. Also, reflectors will be provided with a special steel mill acid-resisting finish—specify on order—Similar to above styles except with special steel mill finish.

‡ ¾-inch can be furnished when specified.

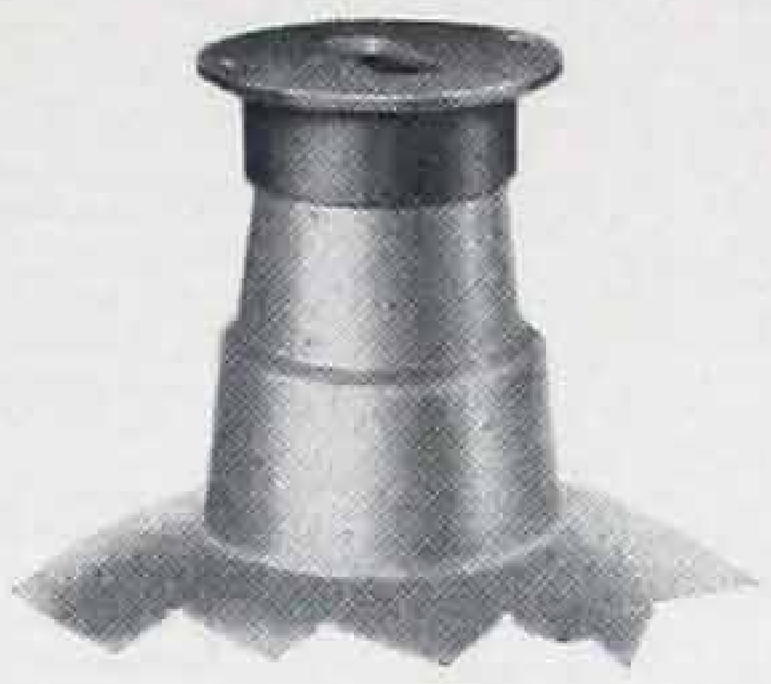
See pages 28 through 32 for ballast and accessory equipment.

HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

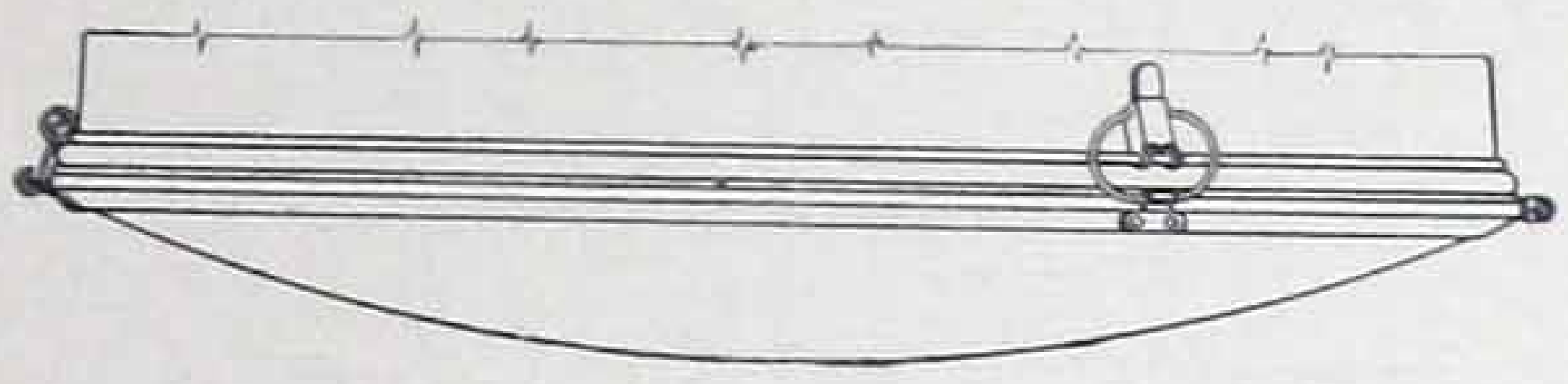
400-WATT ALUMINUM REFLECTORS—LOW, MEDIUM, HIGH MOUNTING

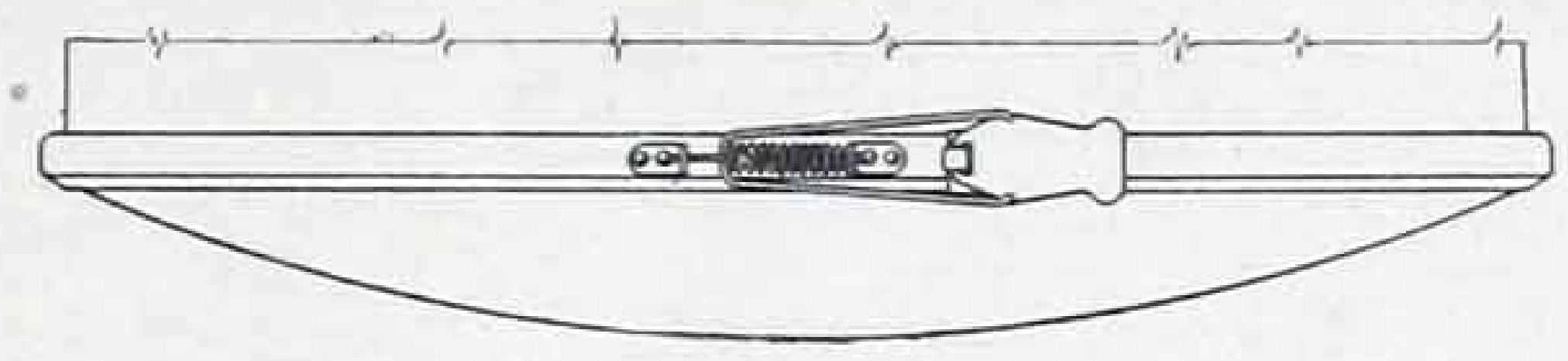

Conduit Mounting
One Piece Reflector

Conduit Mounting
Wemco Quick-Change
Cast Aluminum Hood


Outlet Box Mounting
Wemco Quick-Change
Cast Aluminum Hood

Hinged
Glass
Cover





Snap
Glass
Cover

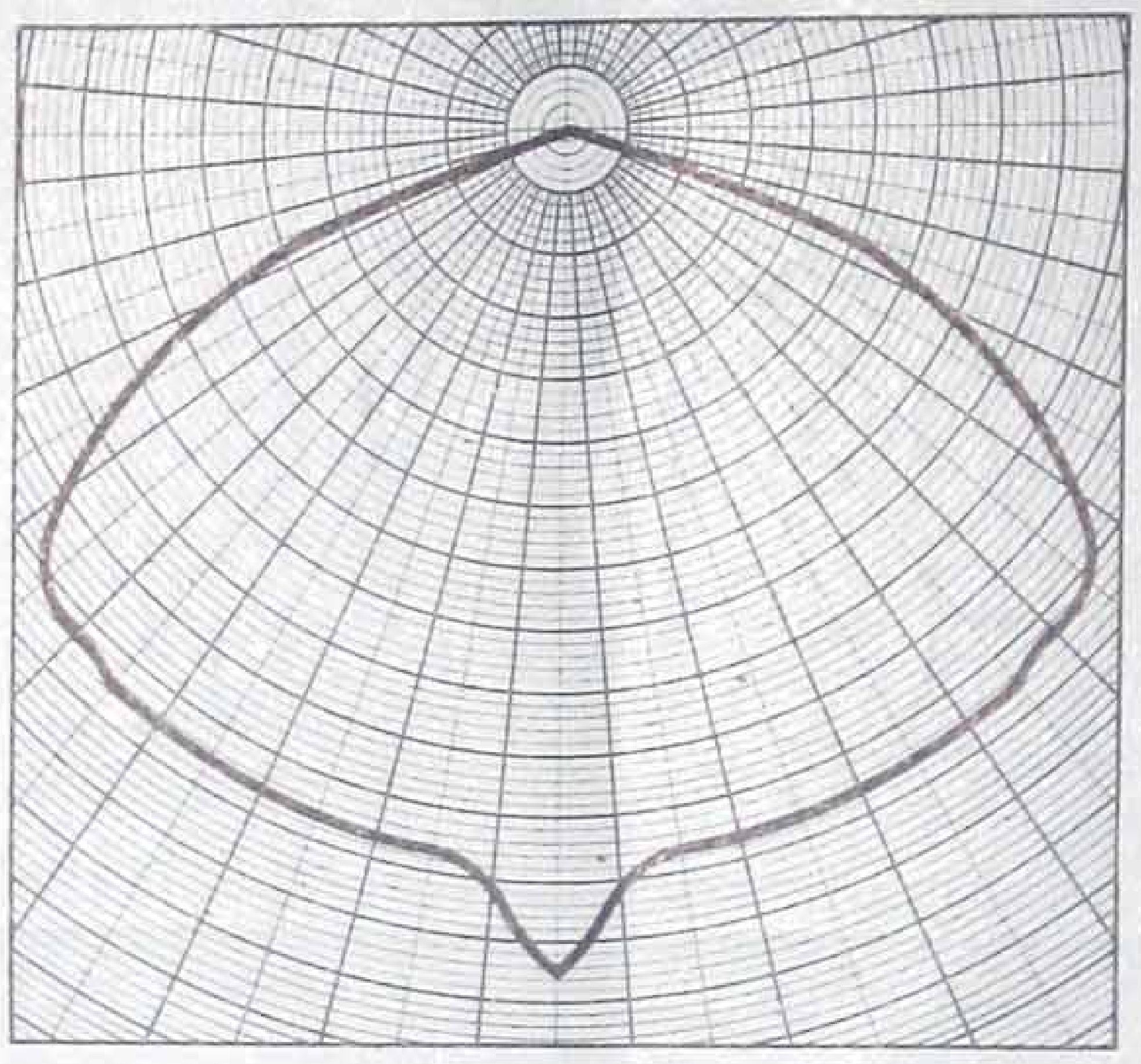
A ROXIMATE MOUNTING HEIGHT			Approximate Spacing (Feet)	Area Per Outlet (Sq. Ft.)	Conditions Factor	AVERAGE FOOTCANDLES		
Low ounting Feet)	Medium Mounting (Feet)	High Mounting (Feet)				Low Mounting	Medium Mounting	High Mounting
		36′ to 50′	12 x 12	140–160	Favorable Average Unfavorable			33–38 26–30 20–23
			13 x 13	160–185	Favorable Average Unfavorable			28–33 22–26 17–20
	26 to 35′		14 x 14	185–210	Favorable Average Unfavorable		30–35 24–27 18–21	25–28 20–22 15–17
8′ to 25′			15 x 15	210–240	Favorable Average Unfavorable	34–39 29–33 21–24	26–30 21–24 16–18	22–25 17–20 13–15
			16 x 16	240–270	Favorable Average Unfavorable	31–35 25–29 18–21	24–26 19–21 14–16	19–22 15–17 12–13
			17 x 17	270–300	Favorable Average Unfavorable	28–31 23–25 16–18	21–24 17–19 13–14	17–19 14–15 10.5–12
			18 x 18	300–340	Favorable Average Unfavorable	24–28 20–23 15–17	19–21 15–17 11–13	16–19 12–14 9.5–10.5
			19 x 19	340–390	Favorable Average Unfavorable	21–25 18–20 13–15	16–19 13–15 10–11	14–16 11–12 8–9.5
			20 x 20	380–430	Favorable Average Unfavorable	19–22 16–18 12–13	15–17 12–13.5 9–10	12–14 9.5–11 7.5–8
			21 x 21	420–470	Favorable Average Unfavorable	18–20 15–16 10–12	13.5–15 11–12 8–9	11–12.5 9–10 7–7.5
			22 x 22	460–520	Favorable Average Unfavorable	16–18 13–15 10–11	12–14 10–11 7.5–8.5	10–11.5 8–9 6–7
			24 x 24	540–590	Favorable Average Unfavorable	14–16 11–13 8–9	11–12 8.5–9.5 6.5–7	9–10 7–8 5.5–6
			26 x 26	640–690	Favorable Average Unfavorable	12–13 10–11 7–8	9.5–10 7.5–8 5.5–6	7.5–8.5 6–6.5 4.5–5
			28 x 28	740–790	Favorable Average Unfavorable	10–11 8.5–9.5 6–7	8–9 6.5–7 5–5.5	
			30 x 30	890–940	Favorable Average Unfavorable	8.5–9.5 7.5–8 5–5.5	7–7.5 5.5–6 4–4.5	
			32 x 32	990–1040	Favorable Average Unfavorable	8–8.5 6.5–7 4.5–5		
			34 x 34	1140–1190	Favorable Average Unfavorable	7–7.5 6–6.5 4–5		

HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

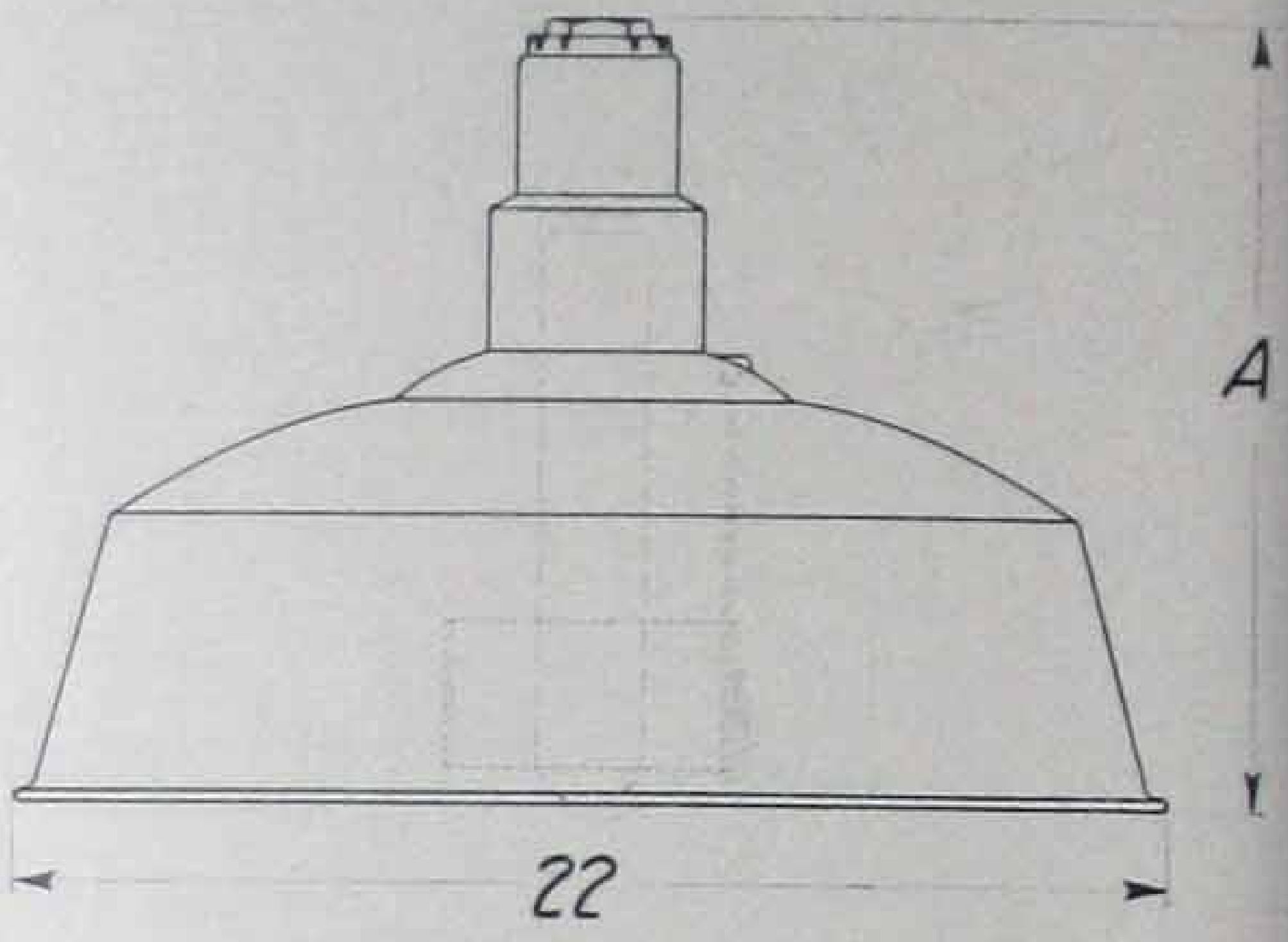
400-WATT DOME REFLECTOR

FOR LOW MOUNTING

400-Watt Dome Reflector



Vertical Distribution with 400-Watt Dome Reflector



Dimensions in Inches
Dome Reflector

Description	Dim. A
One Piece....................	15″
Wemco Quick-Change.....	15⅜″

The Westinghouse Dome Type Low Mounting reflector is designed for use with the 400 Watt High Intensity Mercury lamp for general industrial lighting applications. The shape of the reflector is similar to the well known RLM incandescent reflector. It is equipped with a monax glass cylinder which surrounds the lower portion of the lamp providing the same angle of cut-off (72½°) as the RLM. It should be used on mounting heights of 10 to 18 feet for good general illumination. The proper spacing of units to give the desired intensity can be found on the opposite page.

Construction

The reflector is drawn from 22 gauge iron sheet, and porcelain enameled as follows: one ground coat all over, two white coats inside and one green coat outside with black bead. A glass collar of monax homogeneous glass is supported by three steel cadmium plated supports locked securely in the top portion of reflector. Lamp or collar or both may easily be removed without removing supports.

The special mogul skeleton socket with high heat wax and nickel plated interior is rigidly mounted in the hood to properly position the lamp in the reflector. Various types of hoods are available for mounting as listed below.

Accessories

Since the 400-watt High Intensity Mercury Lamp will not operate on ordinary lighting circuits, it is necessary to provide suitable ballast equipment as described and listed on page 28.

To provide greater flexibility and ease of maintenance between the fixture and ballast equipment, the Westinghouse Safe-Change hanger is recommended.

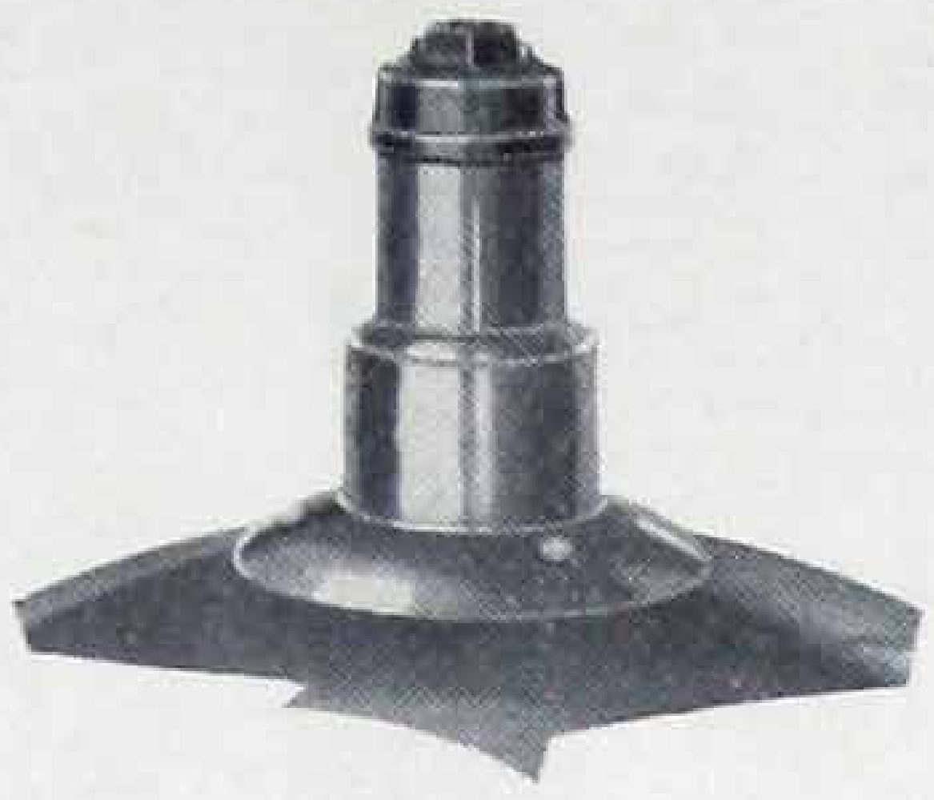
Mercury Lamp Size in Watts	Diameter Inches	Depth Inches	Standard Package Quantity	Standard Package Wt.	½-Inch Conduit Style No.*†	½-Inch Conduit List Price	†4-Inch Outlet Box Style No.*	†4-Inch Outlet Box List Price
ONE-PIECE DOME REFLECTOR COMPLETE WITH SOCKET AND GLASS COLLAR								
400	22	15	4	48	890 005	$8 70	....	....
WEMCO QUICK-CHANGE DOME REFLECTOR COMPLETE WITH HOOD AND GLASS COLLAR								
400	22	15⅜	4	48	890 008	9 10	890 009	$9 10
WEMCO QUICK-CHANGE DOME REFLECTOR AND GLASS COLLAR								
400	22	13½	4	44	890 007	8 30	890 007	8 30
WEMCO QUICK-CHANGE HOODS ONLY								
400	....	1⅞	10	10	347 919	80	347 920	80
GLASS COLLAR ONLY								
400	5½	2 13/16	4	2	888 876	1 00	888 876	1 00

* Style numbers do not include lamps—refer to Westinghouse Lamp Company or its agents.
† ¾ inch can be furnished when specified.
See pages 28 through 32 for ballast and accessory equipment.

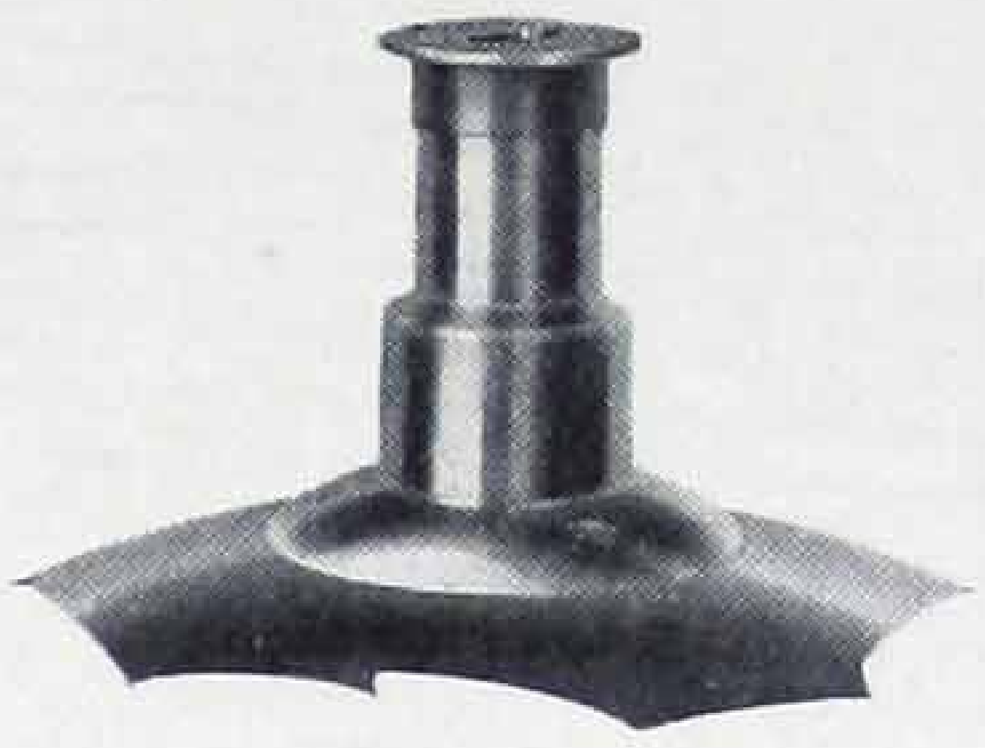
HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

400-WATT DOME REFLECTOR FOR LOW MOUNTING

CONDUIT MOUNTING
ONE PIECE REFLECTOR



CONDUIT MOUNTING
WEMCO QUICK-CHANGE
CAST ALUMINUM HOOD

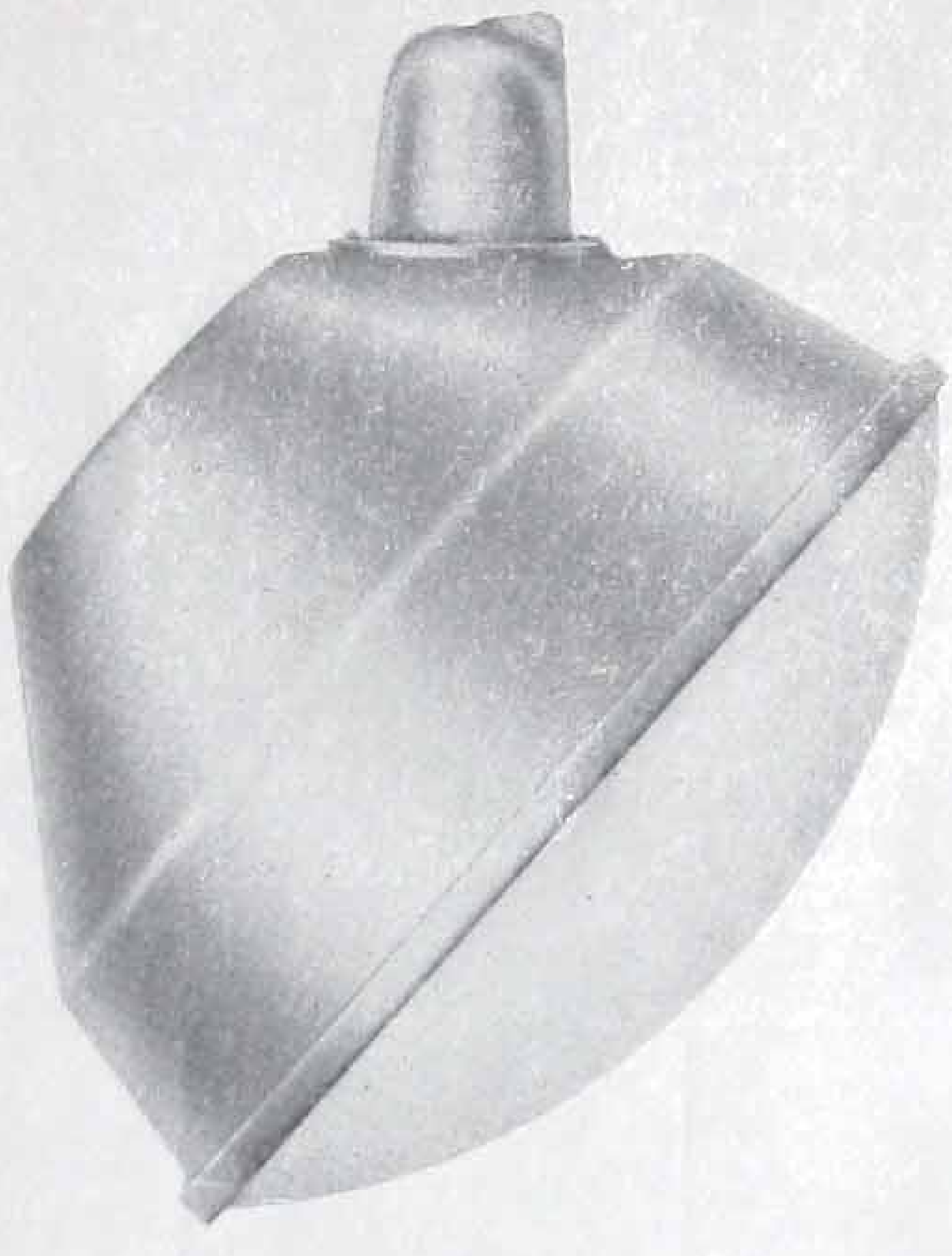


OUTLET BOX MOUNTING
WEMCO QUICK-CHANGE
CAST ALUMINUM HOOD

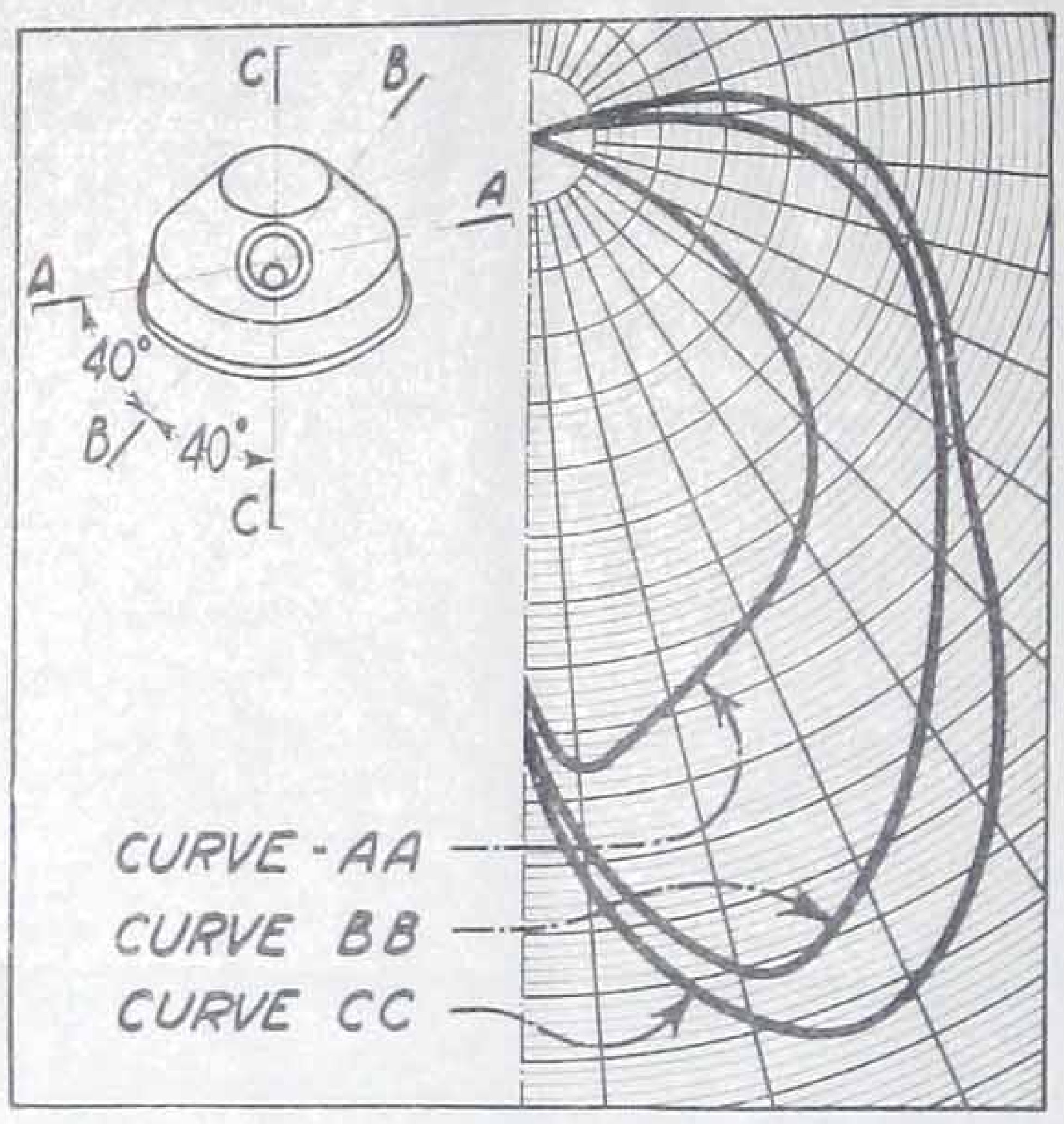
Distance from Underside of Reflector to Floor to be Not less than (Feet)	Approximate Spacing (Feet)	Area per Outlet (Sq. Ft.)	Conditions Factor	Average Footcandles 400-Watt
10	11 x 11	110–125	Favorable Average Unfavorable	48–59 37–48 33–37
10½	11½ x 11½	125–145	Favorable Average Unfavorable	40–50 33–40 27–33
11½	12½ x 12½	145–170	Favorable Average Unfavorable	34–45 27–34 24–27
11½	13½ x 13½	170–200	Favorable Average Unfavorable	30–37 24–30 19–24
12½	14¾ x 14¾	200–230	Favorable Average Unfavorable	25–33 19–25 16–19
13	15½ x 15½	230–260	Favorable Average Unfavorable	22–28 18–22 15–18
13½	16¾ x 16¾	260–300	Favorable Average Unfavorable	19–25 15–19 13–15
14½	18 x 18	300–340	Favorable Average Unfavorable	18–21 13–18 10–13
15½	19 x 19	340–390	Favorable Average Unfavorable	15–18 10–15 9–10
16½	20½ x 20½	390–440	Favorable Average Unfavorable	13–16 10–13 7–9
17	21¾ x 21¾	440–500	Favorable Average Unfavorable	12–15 9–12 6–7

HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

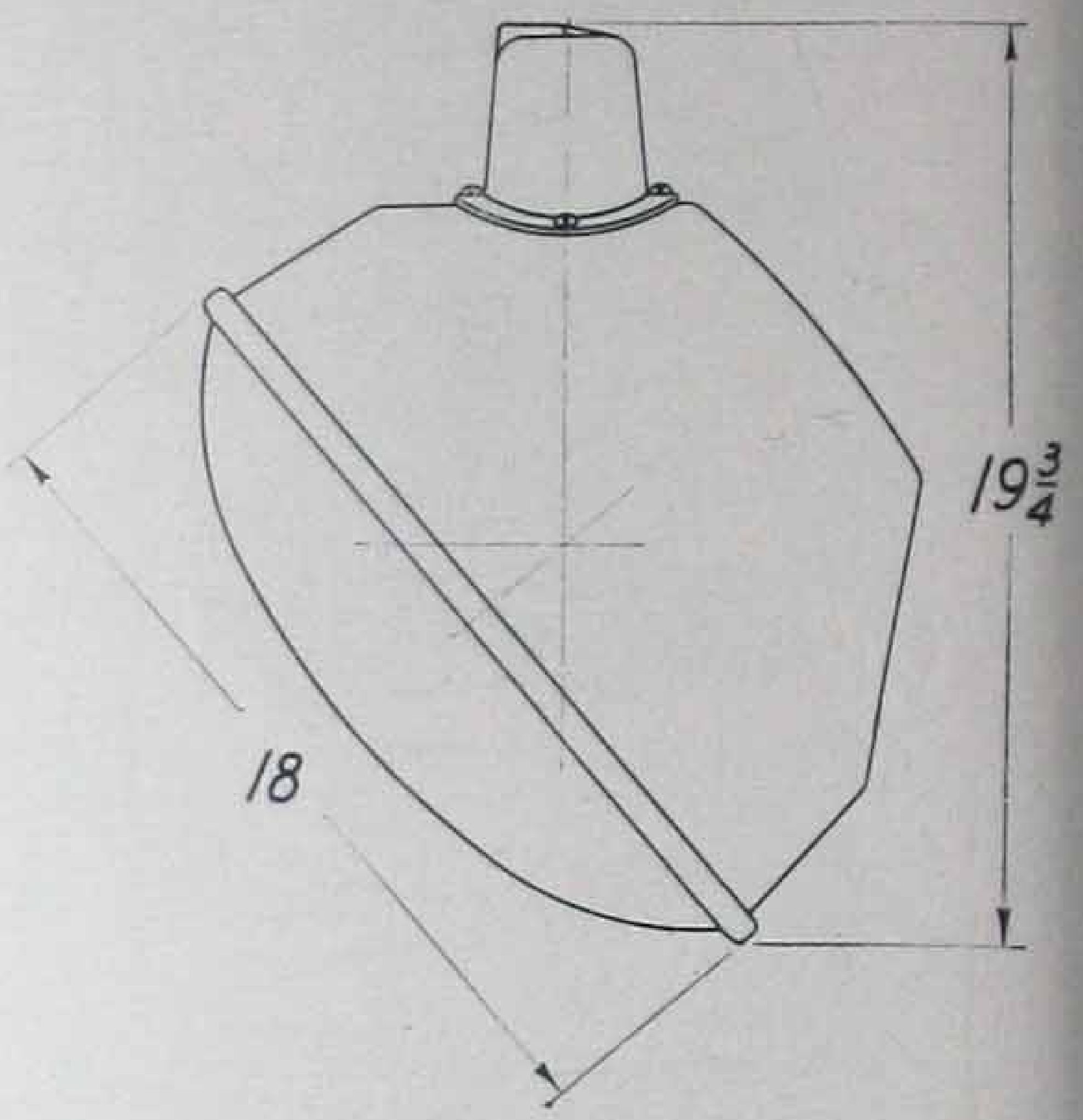
400-WATT BALANCED SYMMETRICAL ANGLE REFLECTOR



400-Watt Balanced Symmetrical Angle Reflector and Glass Cover



Vertical Distribution with 400-Watt Balanced Symmetrical Angle Reflector



Dimensions in Inches Balanced Symmetrical Angle Reflector

The Westinghouse Balanced Symmetrical Angle Reflector is designed especially for use with the 400-Watt High Intensity Mercury Lamp, where intensive local lighting of vertical or horizontal surfaces from the side is required.

The reflector complete with diffusing glass cover is properly designed to give a wide spread distribution of light. The distribution is such that there are no hot spots directly in front of the unit, and uniform illumination results from the overlap of adjacent reflectors. It is particularly adaptable, therefore, to the efficient lighting of spray booths assembly lines, conveyors, inspection frames and many similar applications.

In general it should be mounted from 6 to 9 feet above floor, spaced from 7 to 12 feet apart. Best results, however, will be obtained if spacing is not greater than 10 feet.

Construction

The Symmetrical Angle Reflectors are made from 14 gauge commercially pure etching grade aluminum sheet. Their shape is such as to cause them to be especially strong and durable after fabrication. The special Mogul skeleton type socket with high heat wax and nickel-plated interior is rigidly mounted in the cast aluminum hood which properly positions the lamp in the reflector. The hood is tapped for ½″ conduit mounting and provided with conduit stop. Reflector and hood are held together by four-¼″ bolts together with lock washers and asbestos gasket. Entire reflector is finished by the Alzak process. Hood is painted black inside and aluminum finish outside.

Reflectors are supplied with two types of dust covers, namely; the "snap on type" and the hinged type. Both provide a dust tight joint between glass and reflector. The hinged type allows the bottom part of cover to swing open, thereby providing easy access to lamp and interior of reflector. The glass used in both cases is extra heavy with acid etched inside and smooth outside surfaces.

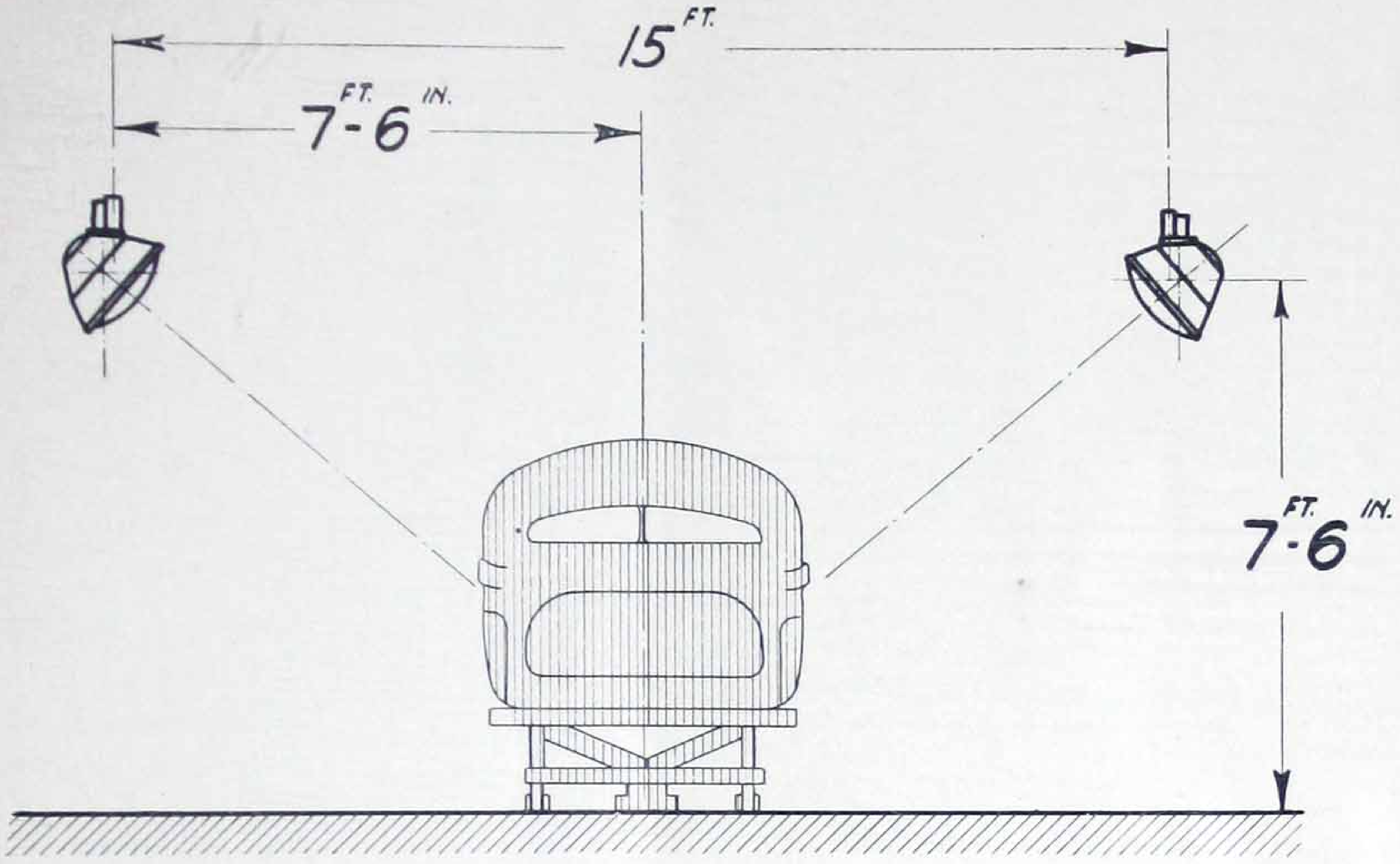
Since the 400-Watt High Intensity Mercury Lamp will not operate on ordinary lighting circuits, it is necessary to provide suitable ballast equipment as described and listed on Page 28.

Mercury Lamp Size in Watts	Diameter Inches	Depth Inches	Standard Package Quantity	Standard Package Wt.	½-inch Conduit Style No.*†	List Price
BALANCED SYMMETRICAL ANGLE REFLECTOR COMPLETE WITH SOCKET AND HINGED COVER						
400	18	19¾	2	30	890 010	$23.60
BALANCED SYMMETRICAL ANGLE REFLECTOR COMPLETE WITH SOCKET AND SNAP COVER						
400	18	19¾	2	30	890 011	23.60
BALANCED SYMMETRICAL ANGLE REFLECTOR AND SOCKET ONLY						
400	18	19¾	2	20	890 012	18.50
HINGED GLASS COVER ONLY						
400	18	....	5	25	890 013	5.10
SNAP GLASS COVER ONLY						
400	18	....	5	25	890 014	5.10
GLASS COVER ONLY FOR HINGED COVER						
400	18	....	5	20	889 158	2.80
GLASS COVER ONLY FOR SNAP COVER						
400	18	....	5	20	889 145	2.80

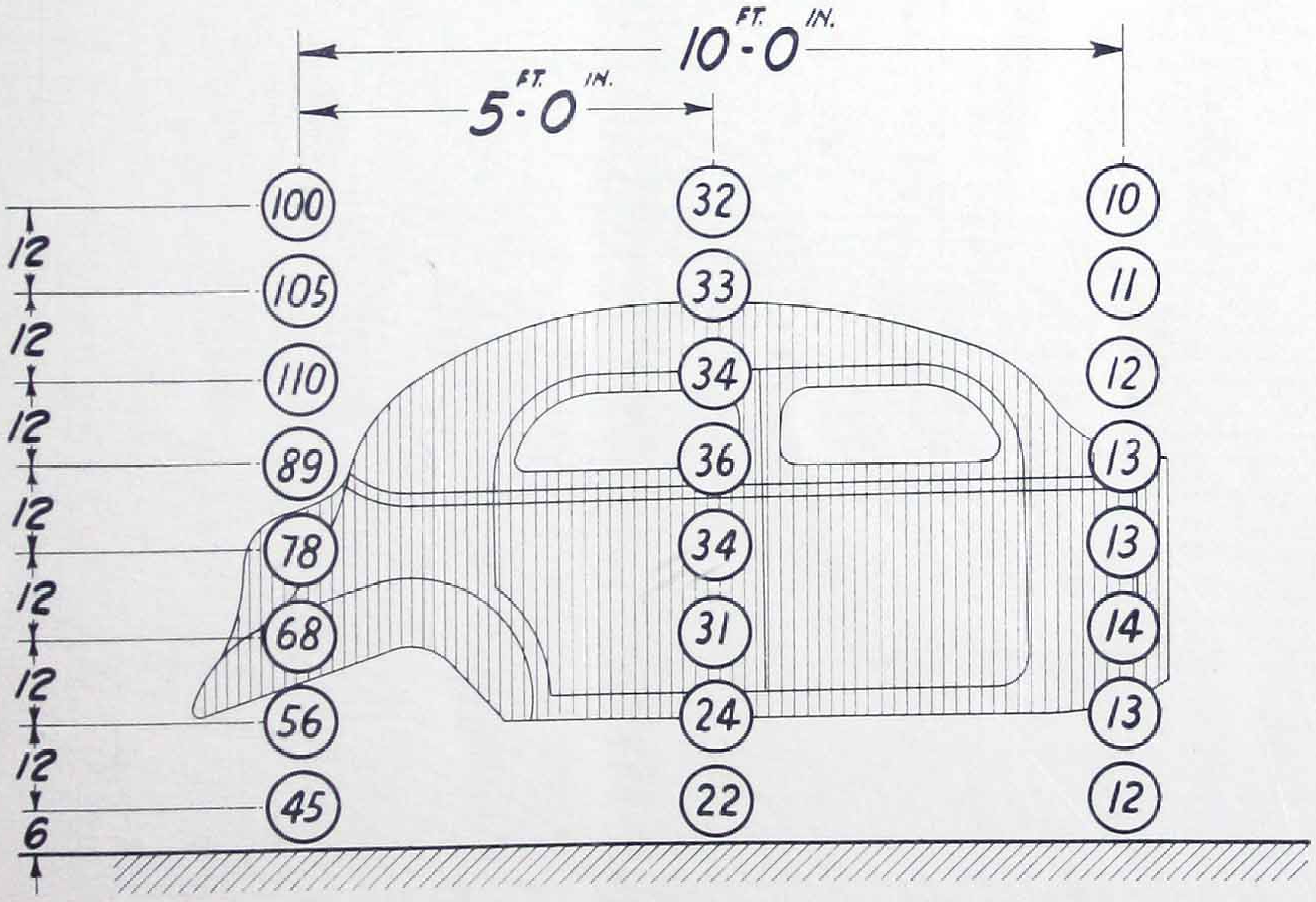
* Style numbers do not include lamps—refer to Westinghouse Lamp Company or its agents.
† ¾-inch can be furnished when specified.
See pages 28 through 32 for ballast and accessory equipment.

HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

400-WATT BALANCED SYMMETRICAL ANGLE REFLECTOR



Above is shown a typical high-level lighting installation for automobile conveyor lines, using Westinghouse Balanced Symmetrical Angle Reflectors with diffusing glass covers. Spacings other than those shown can be used, if desired.



This diagram indicates the approxiate footcandle intensities obtained om one reflector mounted as shown ove. The left-hand column indicates e intensities on a vertical surface directly in front of unit. The center column indicates intensities on a vertical surface 5 feet to right of unit. The third column indicates intensities on a vertical surface 10 feet to right of unit. Therefore, when units are spaced 10 ft. apart, the light from over-lapping sources will build up to practically average intensity.

HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

400-WATT COMBINATION UNIT FOR MERCURY AND INCANDESCENT LAMPS

400-Watt Combination Unit For Mercury and Incandescent Lamps

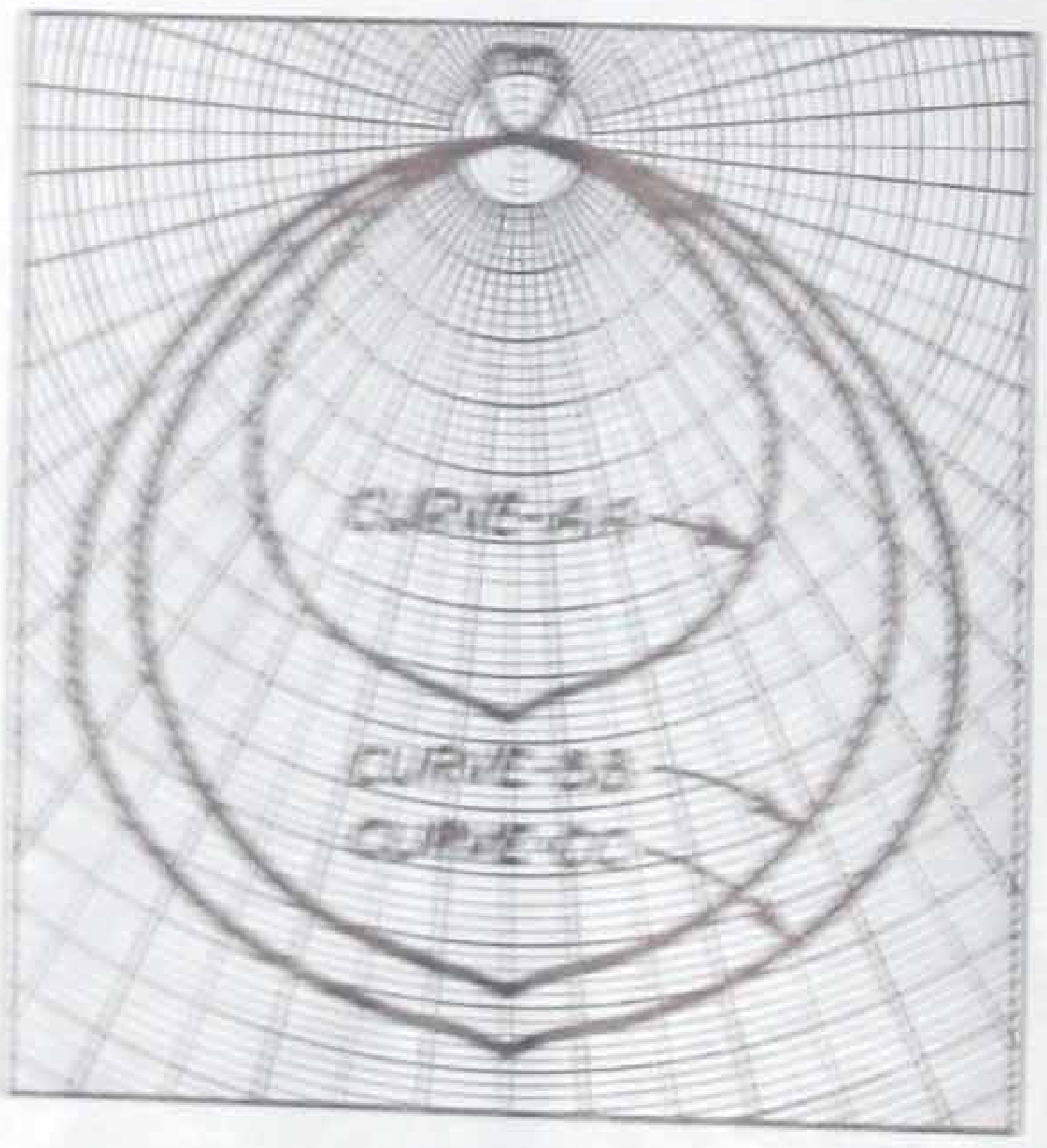
For various applications of Industrial lighting where color correction is desired, the Westinghouse Combination unit effectively and efficiently mixes the light lumens of the 400-Watt High Intensity Mercury Lamp with a quantity of light lumens from ordinary incandescent lamps. It is designed for use on mounting heights of 12 to 18 feet. The spacing should not exceed 1½ times the mounting height.

Two distinct circuits are used, one to control the mercury lamp and one to control the incandescent lamps. The design is such as to allow three incandescent lamps not over 150-watts each to be used without interfering with the restarting of the Mercury lamp in case of a voltage interruption. Three 200-watt lamps may be used but the operating temperature may be too high to permit restarting of the Mercury lamp with the incandescent lamps burning.

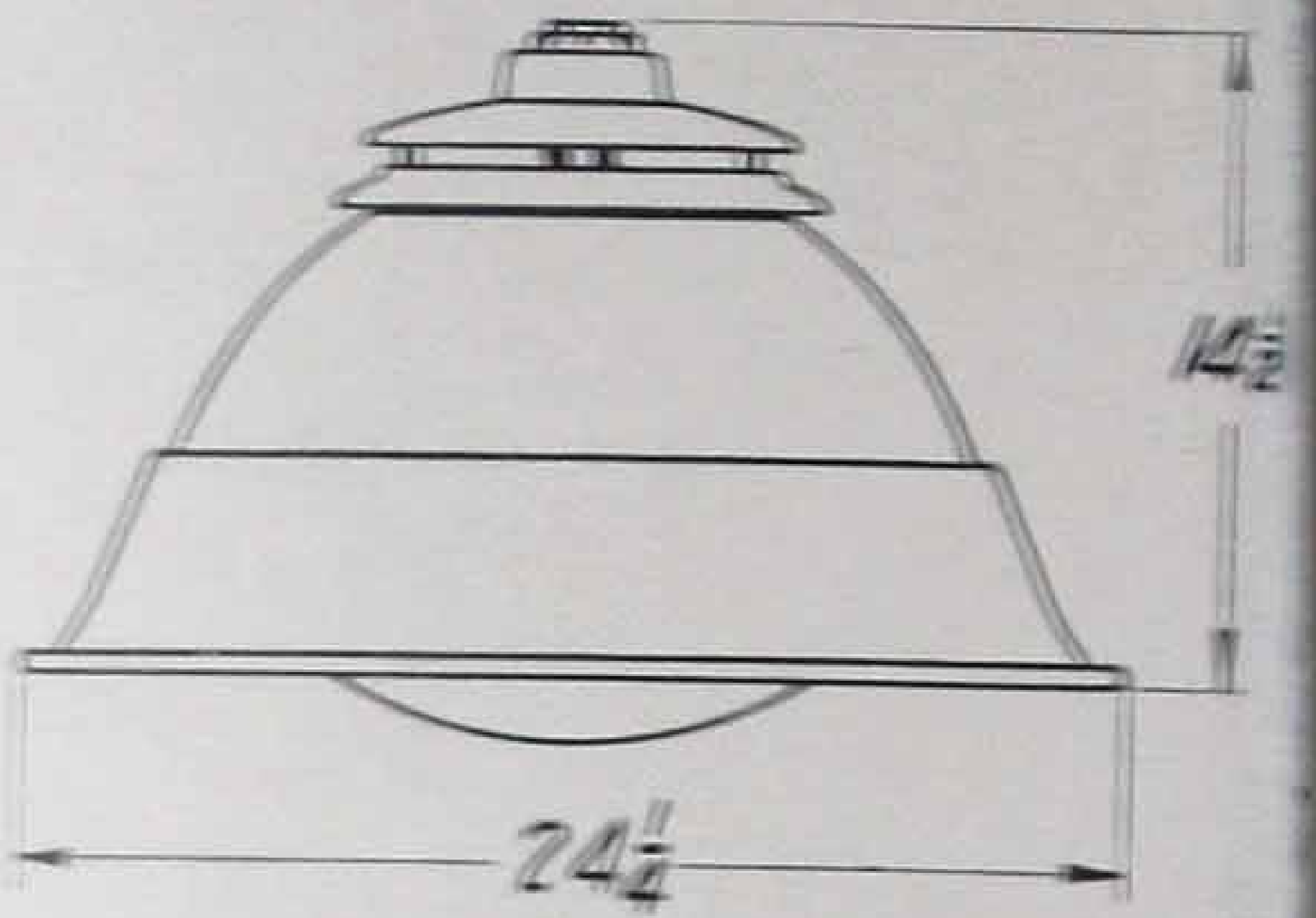
Construction

The complete unit consists of an aluminum reflector with socket assembly and a monax diffusing banded glass bowl.

The reflector is made from #14 gauge etching grade aluminum sheet. The entire socket assembly, which consists of three medium sockets for the incandescent lamps symmetrically spaced about the special skeleton socket for the mercury lamp, are attached directly to the top of the reflector. A slip type louvered cover provides sufficient ventilation for the sockets and allows for wiring or inspection of wiring after reflector is hung. It is arranged f mounting on ½" conduit.



Vertical Distribution with 400-Watt Combination Unit. Curve A-A, 400-Watt Mercury Lamp Only. Curve B-B, 1—400-Watt Mercury Lamp and 3—100-Watt Incandescent Lamps. Curve C-C, 1—400-Watt Mercury Lamp and 3—150-Watt Incandescent Lamps.



Dimensions in Inches 400-Watt Combination Unit

The diffusing bowl is banded at th fitter and hinged in the reflector. simple catch locks globe securely i position. A heavy felt gasket pro vides a dust tight joint between th glass and reflector.

The entire assembly is simple to wir and the hinged bowl provides for quic and easy access to the lamps and elimi nates the hazards of removing larg globes. Sufficient ventilation for th lamp bases and sockets is provided t keep the temperature within saf operating limits. Entire aluminum re flector and louvers are finished by th Alzak process for greater permanenc and ease of cleaning.

Accessories

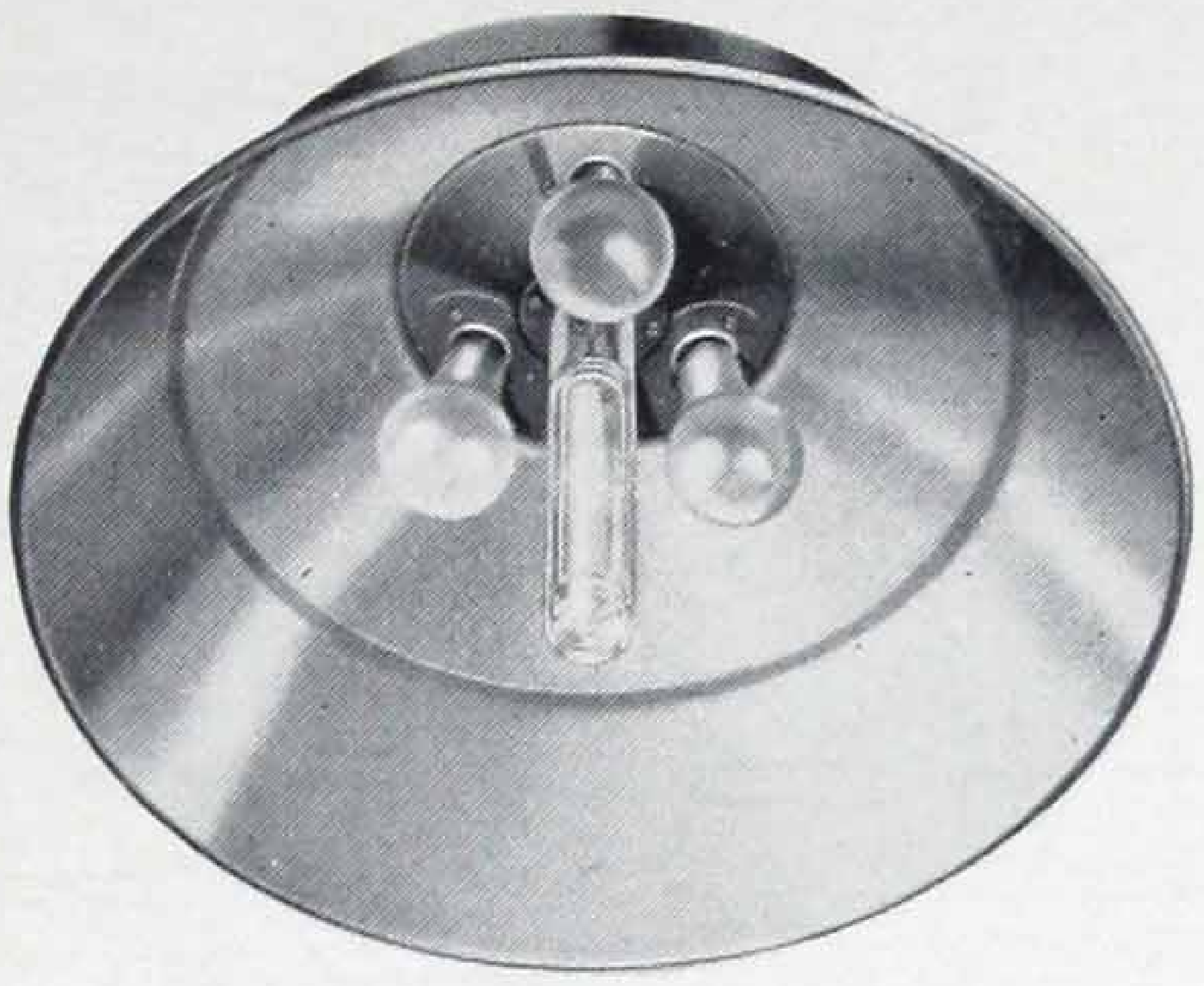
Since the 400-Watt High Intensity Mercury Lamp will not operate on ordinary lighting circuits, it is necessary to provide suitable ballast equipment as described and listed on page 28.

Recommended Lamp Size in Watts	Diameter Inches	Depth Inches	Standard Package Quantity	Standard Package Wt.	½-inch Conduit Style No.*†	½-inch Conduit List Pric
400-WATT COMBINATION UNIT COMPLETE WITH GLASS BOWL						
1—400-watt Mercury 3—150-watt Incandescent	22¾	16	1	30	890 015	$24.90
400-WATT COMBINATION UNIT ONLY						
1—400-watt Mercury 3—150-watt Incandescent	22¾	14½	1	20	890 016	17.65
GLASS BOWL ONLY						
1—400-watt Mercury 3—150-watt Incandescent	18	6¾	1	10	890 017	7.25

* Style numbers do not include lamps—refer to Westinghouse Lamp Company or its agents.
† ¾-inch can be furnished when specified.
See pages 28 through 32 for ballast and accessory equipment.

HIGH INTENSITY MERCURY LIGHTING EQUIPMENT—Continued

400-WATT COMBINATION UNIT FOR MERCURY AND INCANDESCENT LAMPS—Continued



LAMP ARRANGEMENT
COMBINATION UNIT
FOR MERCURY AND INCANDESCENT LAMPS

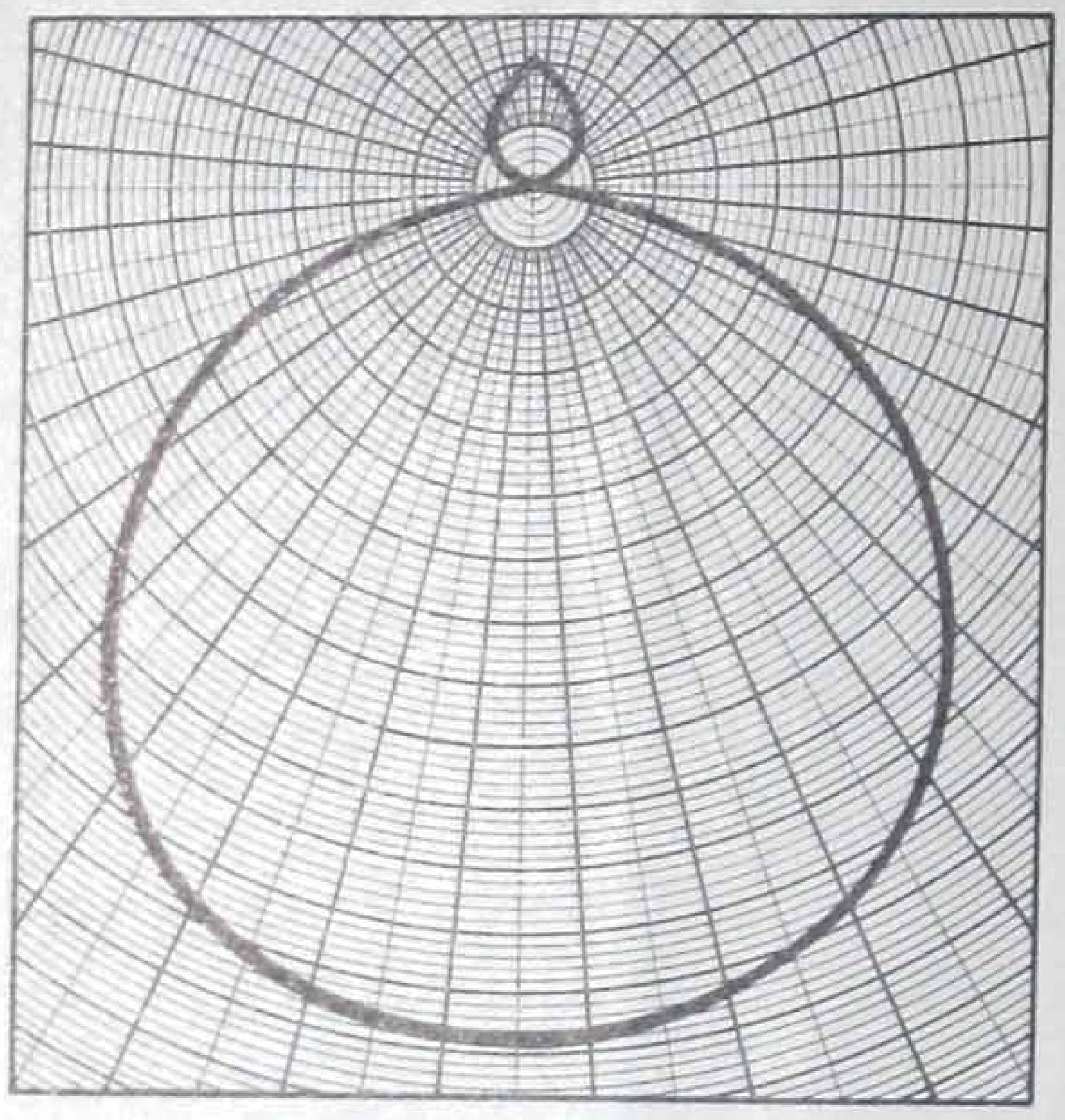
Distance from Underside of Reflector to Floor to be Not less than (Feet)	Approximate Spacing (Feet)	Area per Outlet (Sq. Ft.)	Conditions Factor	Average Footcandles 1—400-Watt Mercury 3—150-Watt Incandescent
12½	14¾ x 14¾	200–230	Favorable Average Unfavorable	40–52 30–40 23–30
13	15½ x 15½	230–260	Favorable Average Unfavorable	35–45 27–35 22–27
13½	16¾ x 16¾	260–300	Favorable Average Unfavorable	32–40 23–32 18–23
14½	18 x 18	300–340	Favorable Average Unfavorable	27–32 22–27 17–22
15½	19 x 19	340–390	Favorable Average Unfavorable	23–30 18–23 14–18
16½	20½ x 20½	390–440	Favorable Average Unfavorable	22–27 17–22 13–17
17	21¾ x 21¾	440–500	Favorable Average Unfavorable	17–22 13–17 11.5–13

HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

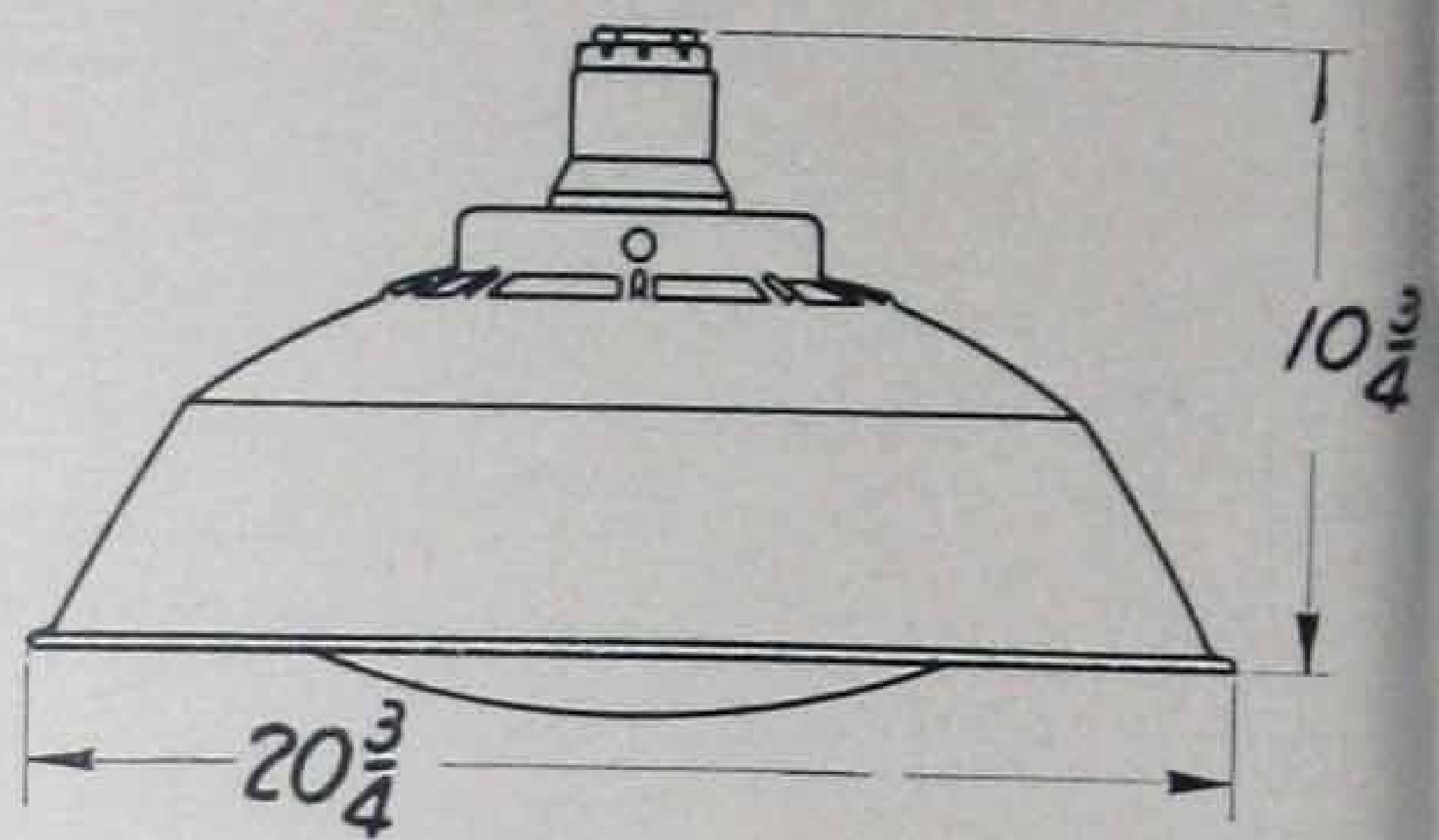
250-WATT GLASSTEEL DIFFUSER

FOR LOW MOUNTING

250-WATT GLASSTEEL DIFFUSER REFLECTOR AND GLOBE



VERTICAL DISTRIBUTION WITH 250-WATT GLASSTEEL DIFFUSER



DIMENSIONS IN INCHES
GLASSTEEL DIFFUSER

The Westinghouse Glassteel Diffuser is designed to properly distribute the light from the 250-watt High Intensity Mercury lamp where the mounting height is under 18 feet. In general this unit can be mounted at practically the same spacings and mounting heights as the standard 300-500 watt incandescent Glassteel Diffuser.

The Glassteel Diffuser consists of a white porcelain enameled reflector which directs the light downward, and a diffusing glass globe. The reflector has six openings at the top which permit some light to reach the ceiling, thus reducing the contrast between the ceiling and lighting unit. The diffusing glass globe conceals the bright light source, thereby minimizing glare and softening shadows.

The High Intensity Glassteel Diffuser is especially suitable for lighting machine shops, plating and polishing rooms, assembly lines and departments, pattern shops, printing plants, tool rooms, stamping departments, finishing and inspection departments and welding forge and heat treating rooms.

Construction

High Intensity Glassteel Diffuser reflector is drawn from 22 gauge iron sheet and porcelain enameled as follows: one ground coat all over and two white coats of porcelain enamel inside and outside.

The diffusing globe is of single layer homogeneous glass and is provided with a copper globe protecting ring.

Various types of hoods are available for mounting as listed below. Complete descriptions of the applicable hoods can be found in Catalog Sections 61-140 and 61-153.

Since the 250-watt High Intensity Mercury lamp will not operate on ordinary lighting circuits, it is necessary to provide suitable ballast equipment as described and listed on page 28.

To provide greater flexibility and ease of maintenance between the fixture and the ballast equipment, the Westinghouse Safe-Change Hanger is recommended.

Mercury Lamp Size in Watts	Diameter Inches	Depth Inches	Standard Package Quantity	Standard Package Wt.	½-Inch Conduit Style No.*†	½-Inch Conduit List Price	4-Inch Conduit Style No.*	4-Inch Conduit List Price
ONE-PIECE GLASSTEEL DIFFUSER COMPLETE WITH SOCKET AND GLOBE								
250	20¾	11	4	60	890 018	$12 50	....	......
ONE-PIECE GLASSTEEL DIFFUSER REFLECTOR AND SOCKET ONLY								
250	20¾	10¾	4	45	890 019	8 90	....	......
WEMCO QUICK-CHANGE GLASSTEEL DIFFUSER COMPLETE WITH HOOD AND GLOBE								
250	20¾	11⅛	4	60	890 020	12 90	890 021	$12 90
WEMCO QUICK-CHANGE GLASSTEEL DIFFUSER REFLECTOR ONLY								
250	20¾	8⅛	4	40	890 022	8 50	890 022	8 50
WEMCO QUICK-CHANGE HOODS ONLY								
250	....	1⅞	10	10	789 223	80	789 221	80
GLASSTEEL DIFFUSER GLOBE ONLY								
250	12	....	4	15	888 334	3 60	888 334	3 60

* Style numbers do not include lamps—refer to Westinghouse Lamp Company or its agents.

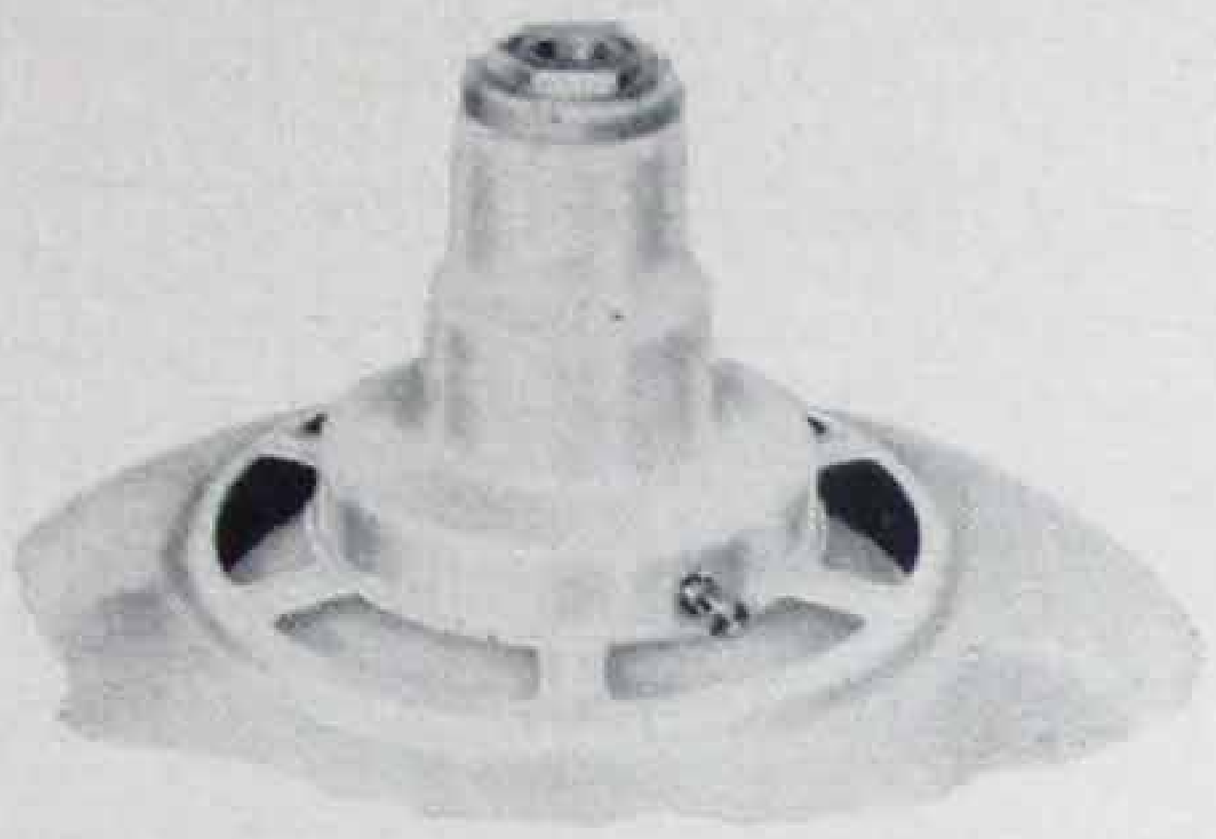
† ¾-inch can be furnished when specified.

See pages 28 through 32 for ballast and accessory equipment.

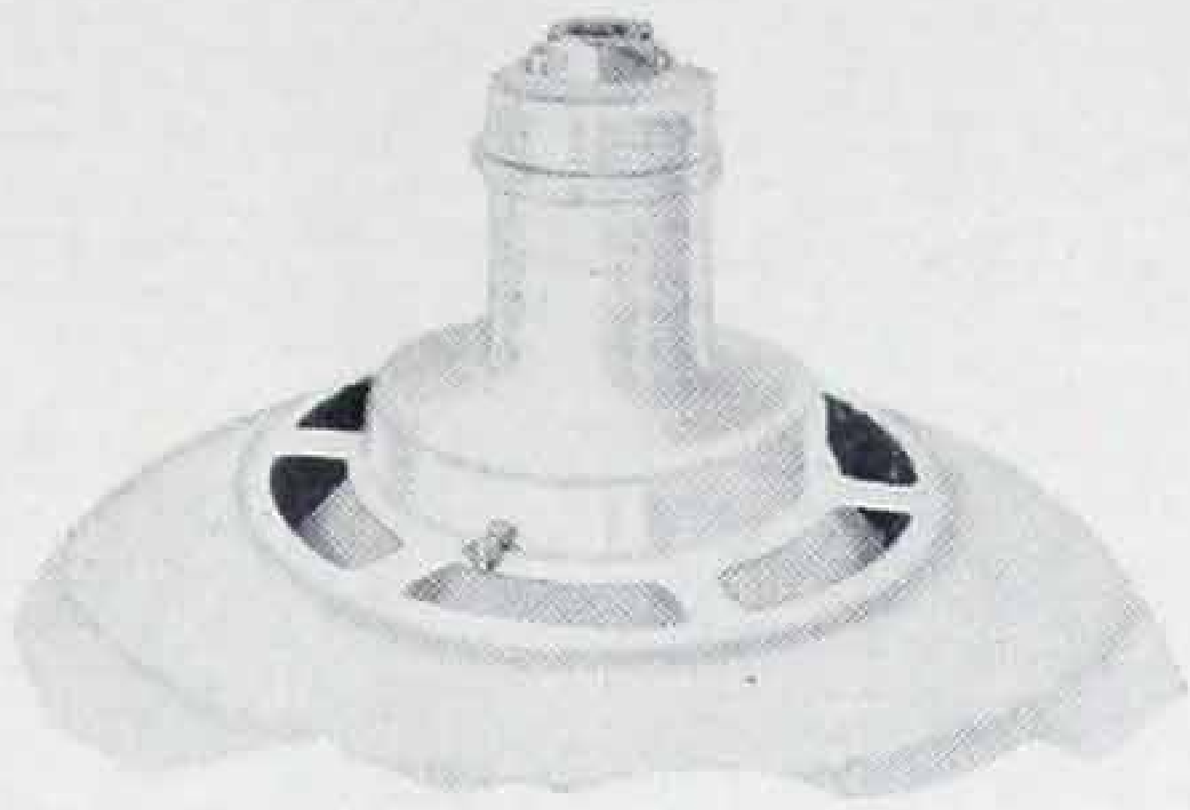
HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

250-WATT GLASSTEEL DIFFUSER

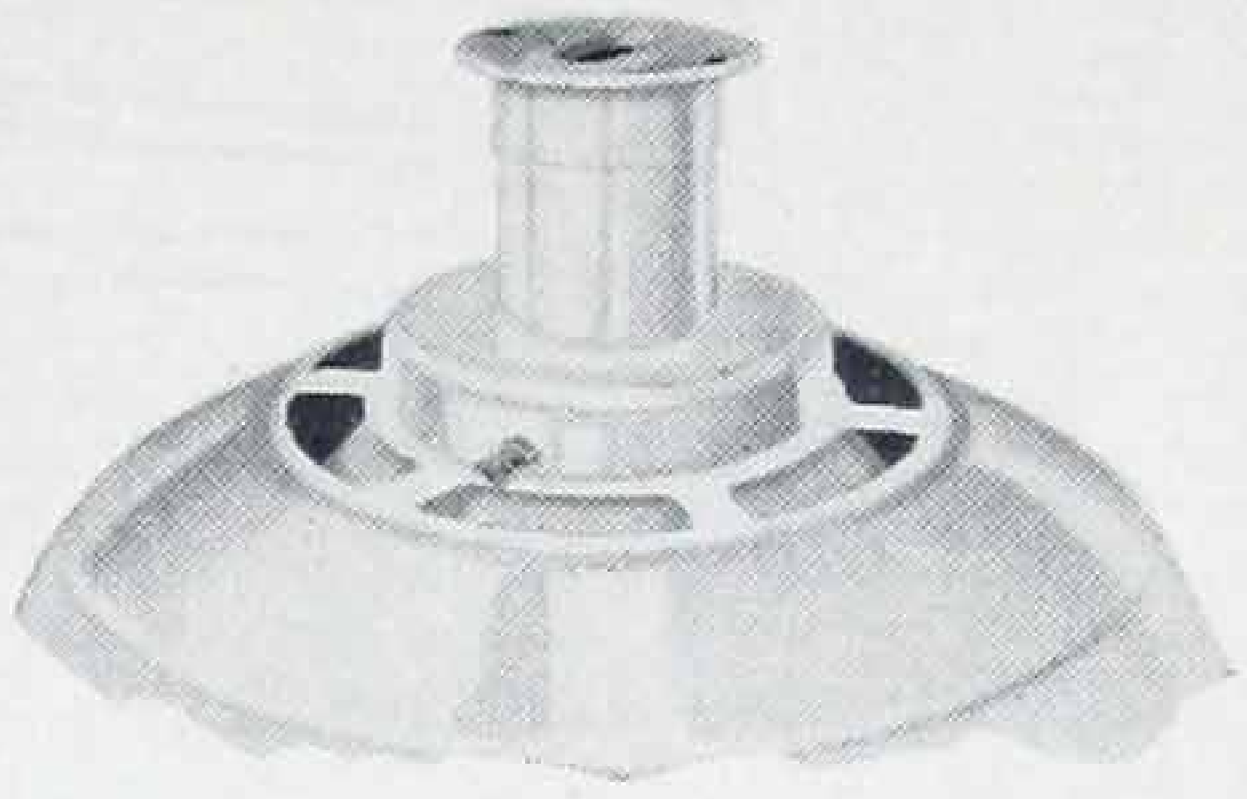
FOR LOW MOUNTING



Conduit Mounting
One Piece Reflector



Conduit Mounting
Wemco Quick-Change
Cast Aluminum Hood



Outlet Box Mounting
Wemco Quick-Change
Cast Aluminum Hood

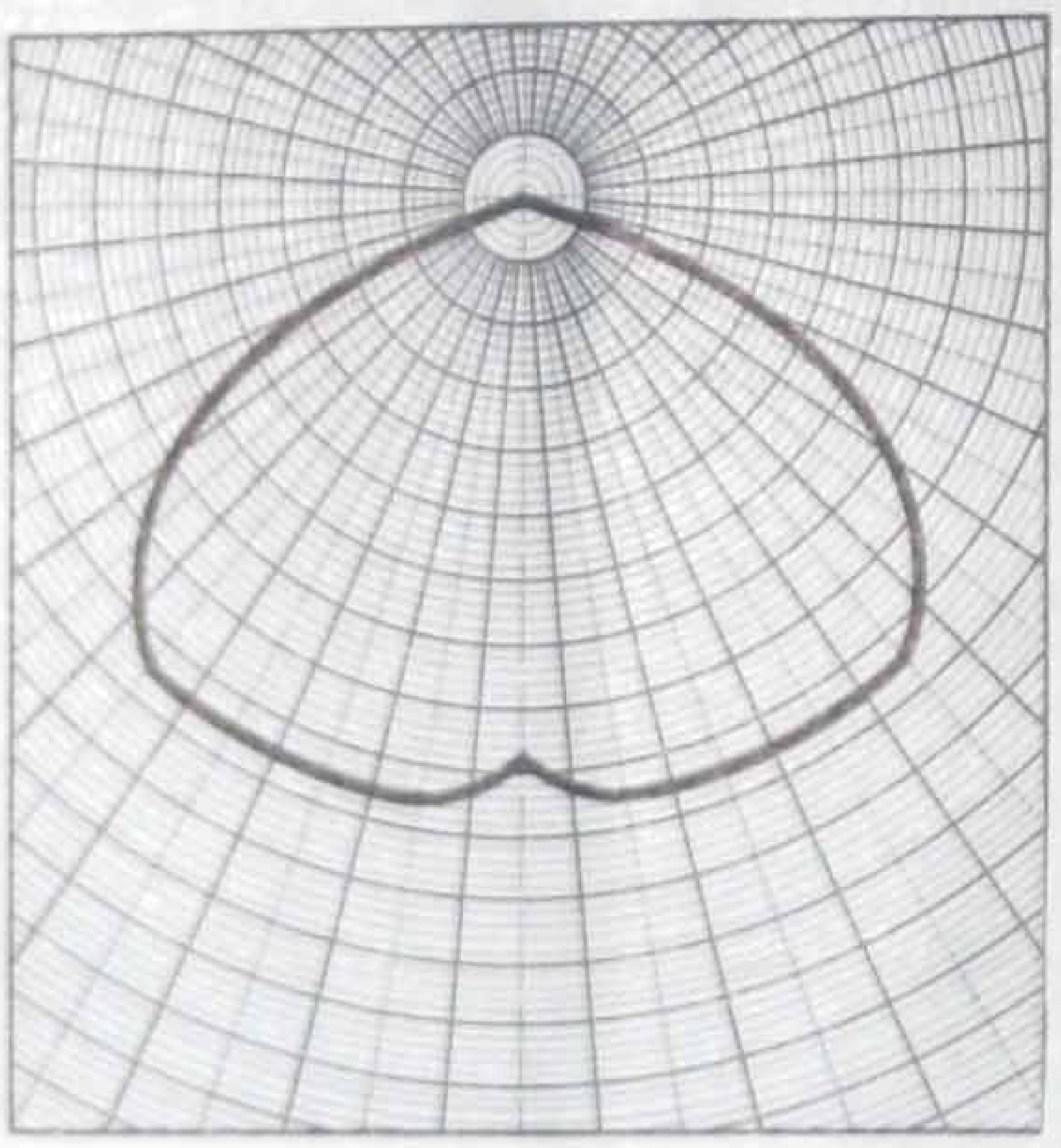
Distance from Underside of Reflector to Floor to be Not less than (Feet)	Approximate Spacing (Feet)	Area per Outlet (Sq. Ft.)	Conditions Factor	Average Footcandles 250-Watt
7½	7¾ x 7¾	55–65	Favorable Average Unfavorable	40–52 30–40 24–31
8½	8½ x 8½	65–75	Favorable Average Unfavorable	34–42 25–34 20–25
8½	9 x 9	75–85	Favorable Average Unfavorable	30–38 22–29 18–22
9	9½ x 9½	85–95	Favorable Average Unfavorable	27–34 20–27 16–20
9½	10 x 10	95–110	Favorable Average Unfavorable	25–32 18–25 16–18
10	11 x 11	110–125	Favorable Average Unfavorable	21–27 16–21 13–16
10½	11½ x 11½	125–145	Favorable Average Unfavorable	18–24 14–18 11–14
11½	12½ x 12½	145–170	Favorable Average Unfavorable	17–21 13–17 10–13
11½	13½ x 13½	170–200	Favorable Average Unfavorable	14–17 10–14 9–10.5
12½	14¾ x 14¾	200–230	Favorable Average Unfavorable	11–14 9–11 7.5–9
13	15½ x 15½	230–260	Favorable Average Unfavorable	10.5–12.5 8.5–10 6–7.5
13½	16¾ x 16¾	260–300	Favorable Average Unfavorable	10–11 7–8.5 5.5–6.5
14½	18 x 18	300–340	Favorable Average Unfavorable	7–10 5.5–7 5–5.5
15½	19 x 19	340–390	Favorable Average Unfavorable	6.5–8.5 5–5.5 4–5
16½	20½ x 20½	390–440	Favorable Average Unfavorable	5.5–7 4–5.5 3.5–4
17	21¾ x 21¾	440–500	Favorable Average Unfavorable	5–5.5 3.5–5 3–3.5

HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

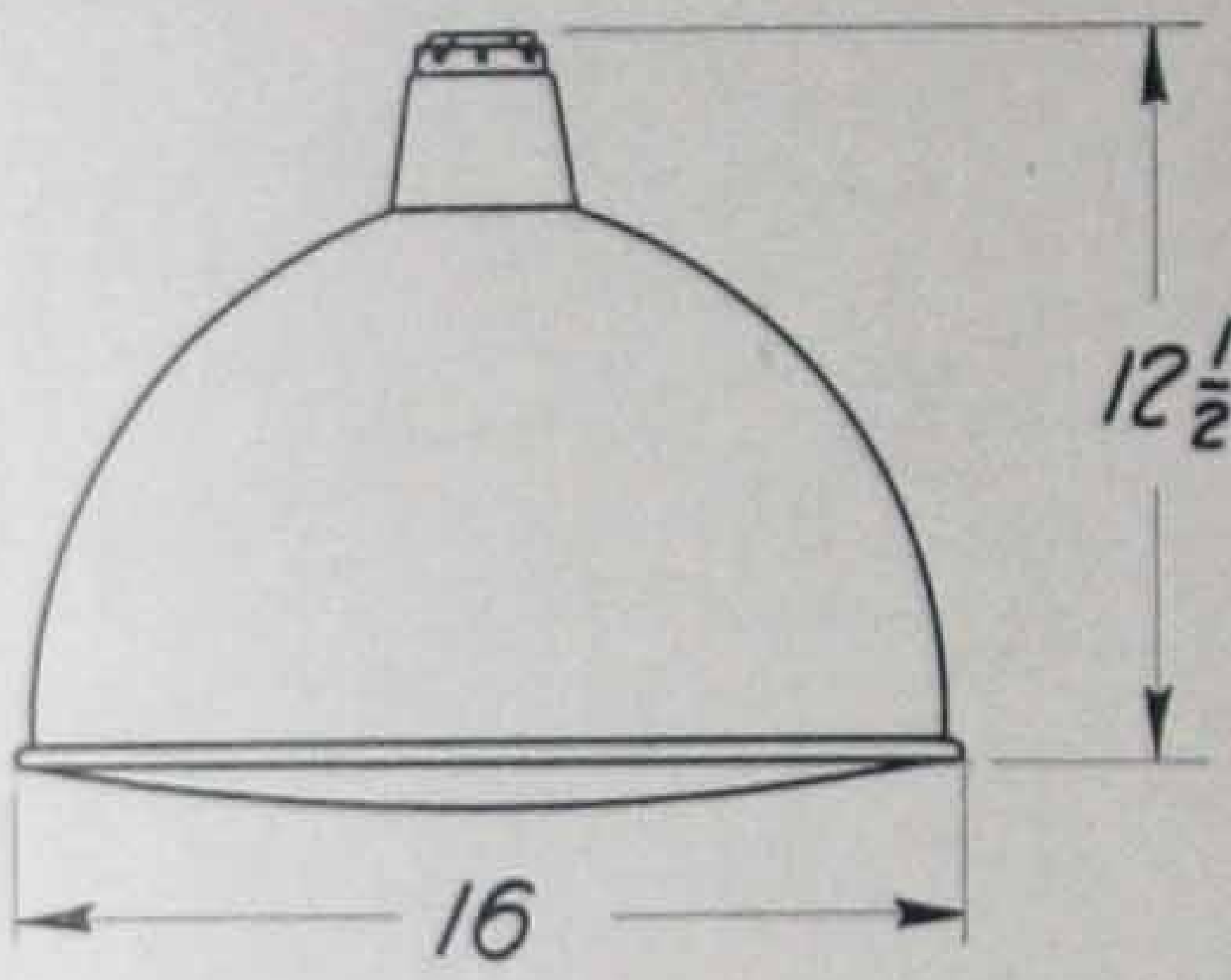
250-WATT ALUMINUM REFLECTOR

FOR LOW MOUNTING

250-Watt Aluminum Reflector and Glass Cover



Vertical Distribution with 250-Watt Aluminum Reflector



Dimensions in Inches
Aluminum Reflector

Westinghouse Enclosed Aluminum Dome Type Low Mounting units provide intensive general illumination where the Mounting Light is not over 20 feet. Higher intensities are provided on the working plans, with minimum losses on the side walls.

The complete unit consists of an Alzaked Deep Bowl Type Aluminum reflector, a dust-tight cover, and various types of hoods, such as One-Piece and Wemco Quick-Change, for ½″ conduit and outlet box mounting. Complete descriptions of the applicable hoods will be found in Catalog Sections 61-140 and 61-153.

Construction

The reflectors are made from 16 gauge commercially pure etching grade aluminum sheet. The medium socket with high heat wax and nickel plated interior is rigidly mounted in the hood to properly locate the lamp in the reflector.

The clear glass cover is hinged directly to the reflector bead, supported at three points. It is released by unsnapping two latches. A heavy waterproof felt provides a gasket between reflector and lens.

The entire reflector is finished by the Alzak process for greater permanence and ease of cleaning.

Accessories

Since the 250-watt High Intensity Mercury lamp will not operate on ordinary lighting circuits, it is necessary to provide suitable ballast equipment as described and listed on page 28.

To provide greater flexibility and ease of maintenance between the fixture and the ballast equipment, the Westinghouse Safe-Change hanger is recommended.

Mercury Lamp Size in Watts	Diameter Inches	Depth Inches	Standard Package		½-Inch Conduit		4-Inch Outlet Box	
			Quantity	Wt.	Style No.*†	List Price	Style No.*	List Price
ONE-PIECE ALUMINUM REFLECTOR COMPLETE WITH SOCKET AND HINGED COVER								
250	16	14	4	40	890 023	$17 10	... .	... ...
ONE-PIECE ALUMINUM REFLECTOR AND SOCKET ONLY								
250	16	12½	4	25	890 024	13 50	....	... ...
WEMCO QUICK-CHANGE ALUMINUM REFLECTOR COMPLETE WITH HOOD AND HINGED COVER								
250	16	14⅛	4	40	890 025	17 50	890 026	$17 50
WEMCO QUICK-CHANGE ALUMINUM REFLECTOR ONLY								
250	16	10¾	4	20	890 027	13 10	890 027	13 10
WEMCO QUICK-CHANGE HOODS ONLY								
250	....	1⅜	10	10	347 919	80	347 920	80
HINGED GLASS COVER ONLY								
250	16	....	4	14	341 065	3 60	341 065	3 60
GLASS LENS ONLY								
250	16	....	4	12	341 069	1 50	341 069	1 50

* Style numbers do not include lamps—refer to Westinghouse Lamp Company or its agents.

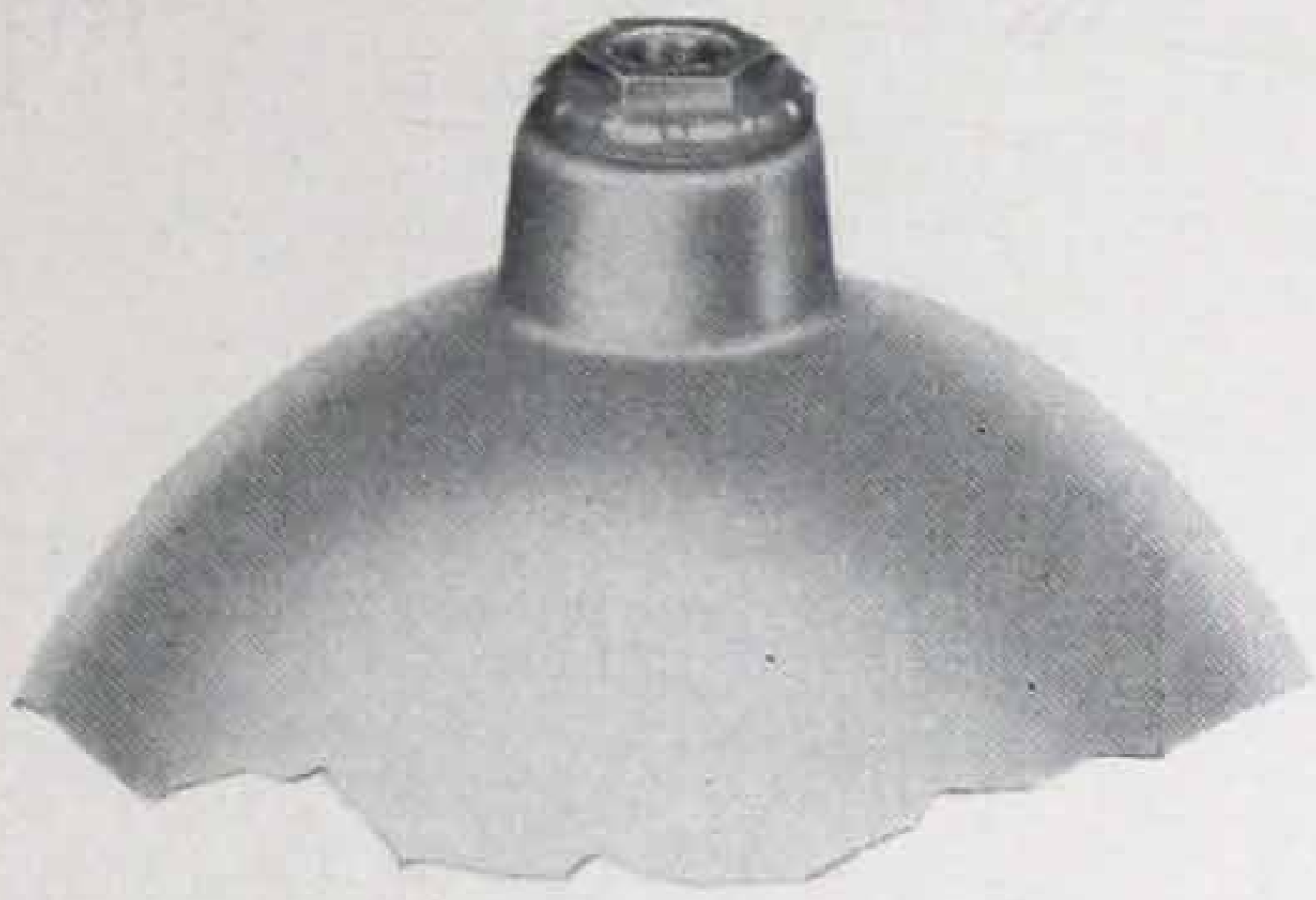
† ¾-inch can be furnished when specified.

See pages 28 through 32 for ballast and accessory equipment.

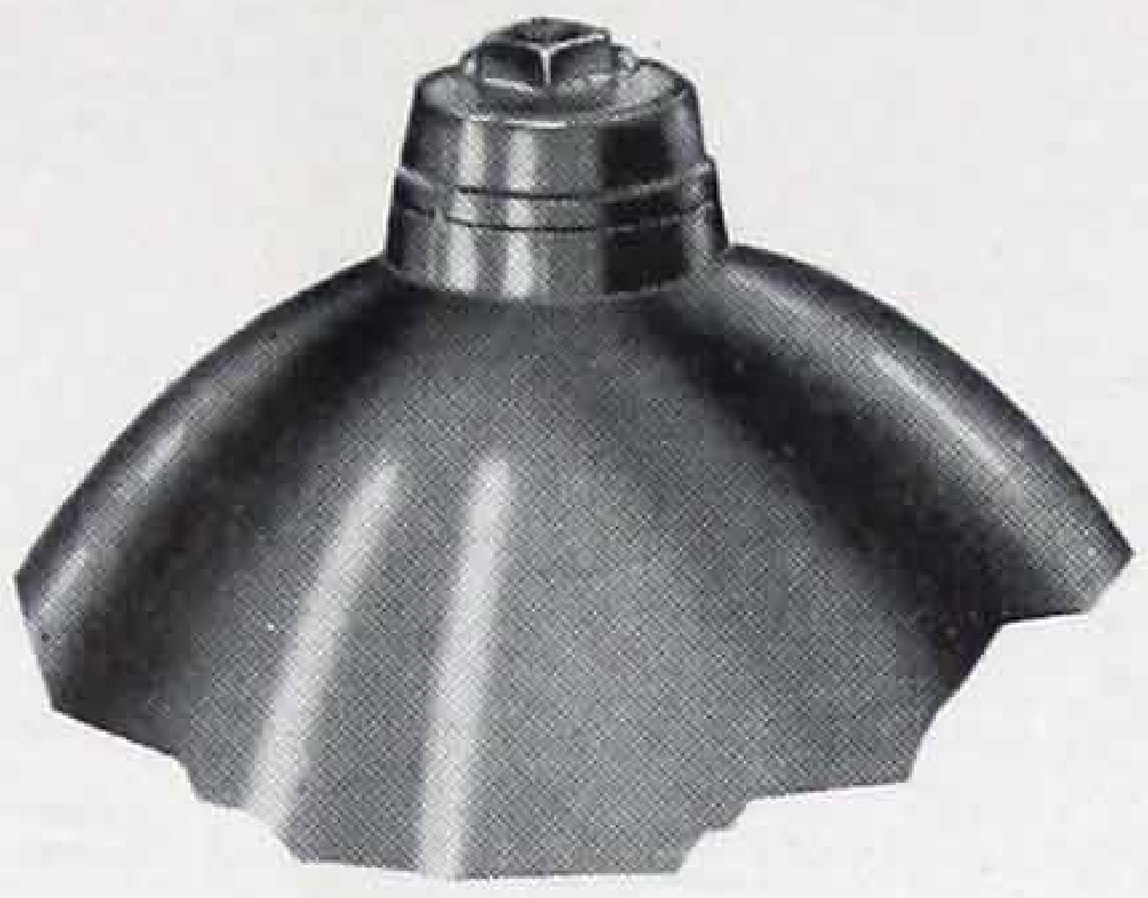
HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

250-WATT ALUMINUM REFLECTOR

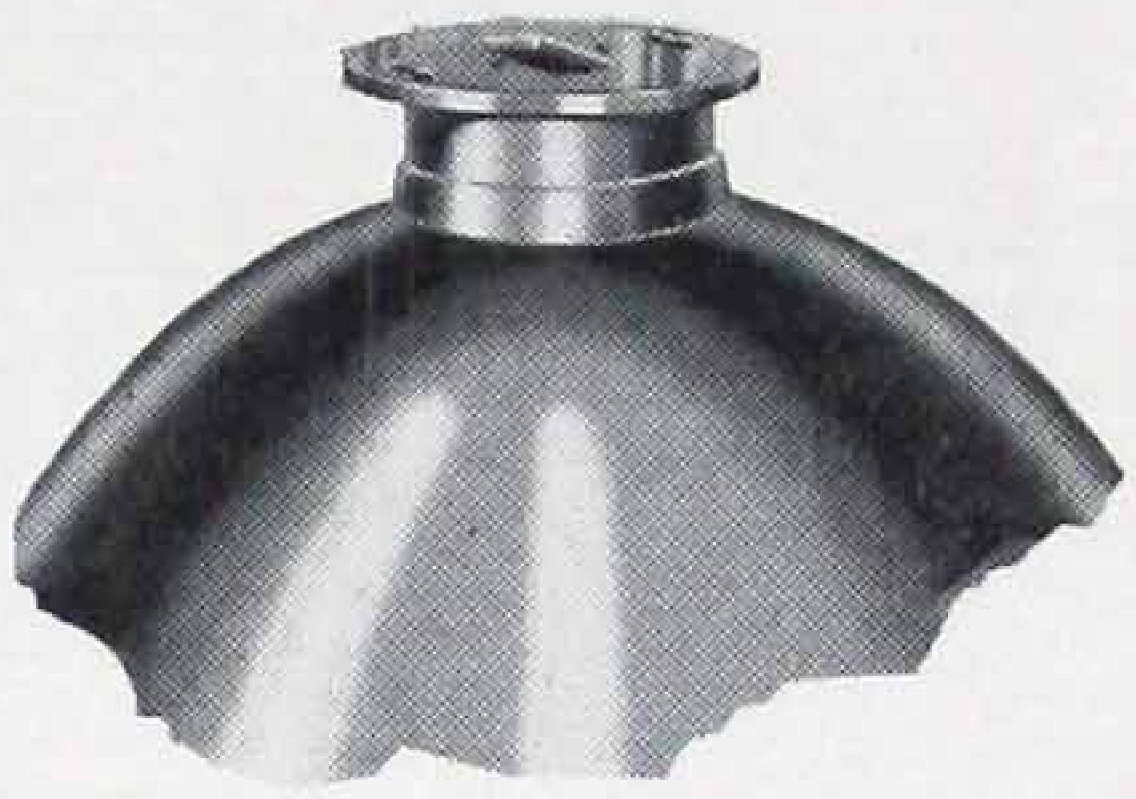
FOR LOW MOUNTING



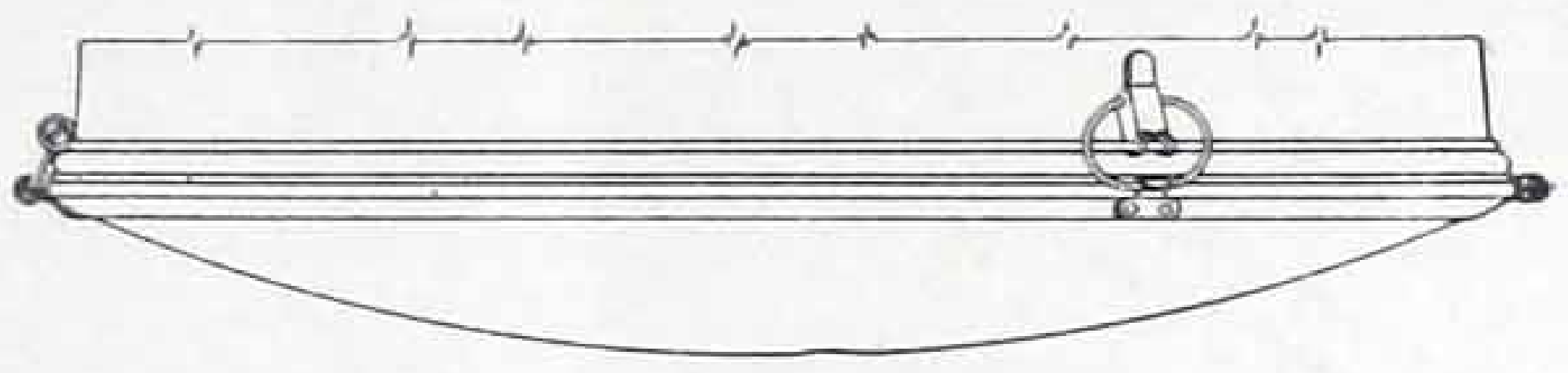
Conduit Mounting
One Piece Reflector



Conduit Mounting
Wemco Quick-Change
Cast Aluminum Hood



Outlet Box Mounting
Wemco Quick-Change
Cast Aluminum Hood



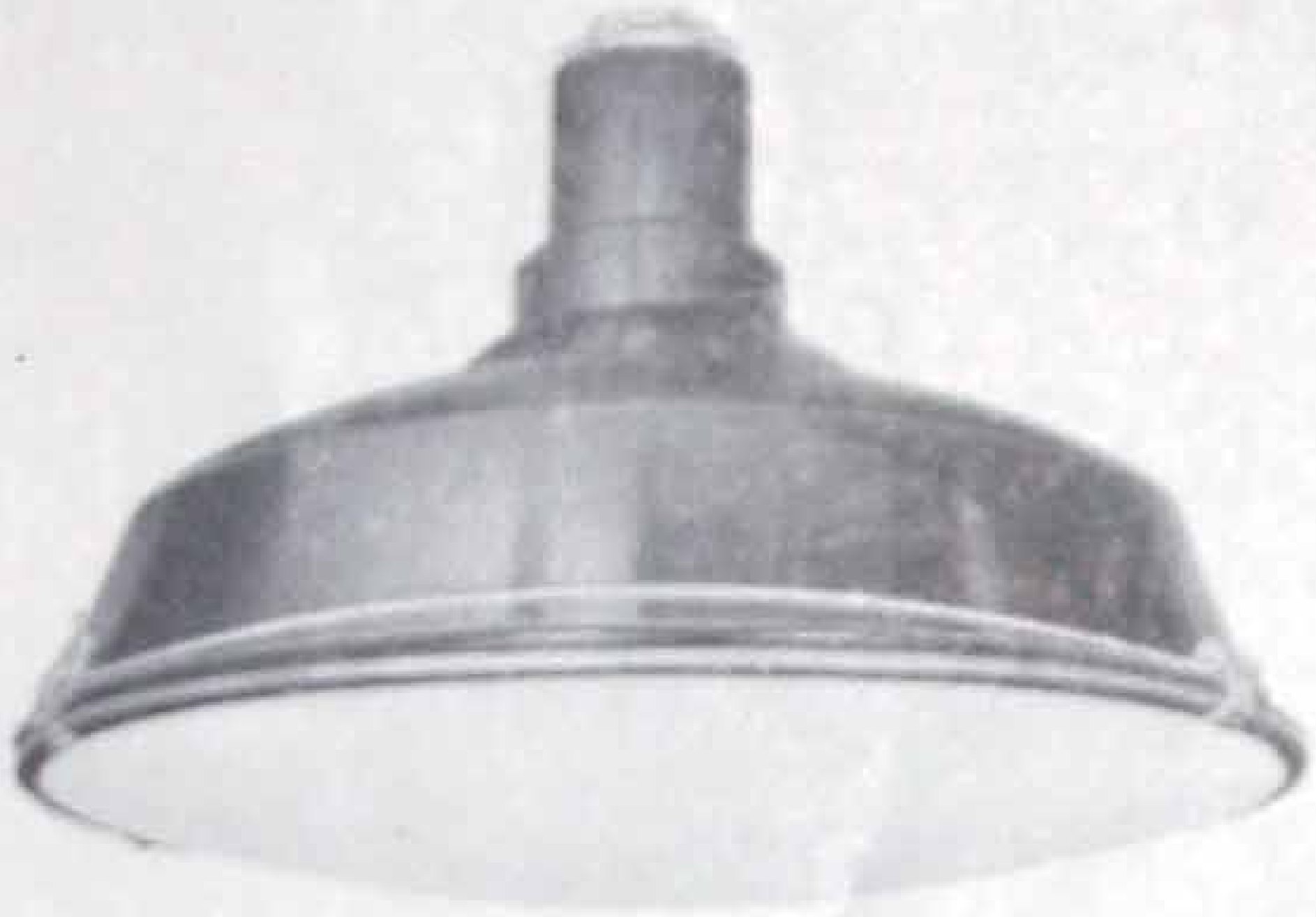
Hinged Glass Cover

Mounting Height (Feet)	Approximate Spacing (Feet)	Area Per Outlet (Sq. Ft.)	Conditions Factor	Average Footcandles 250-Watt
10′ to 20′	8 x 8	60–70	Favorable Average Unfavorable	52–60 43–50 32–38
	9 x 9	75–85	Favorable Average Unfavorable	42–48 35–40 27–30
	10 x 10	95–110	Favorable Average Unfavorable	33–38 27–32 20–24
	11 x 11	115–130	Favorable Average Unfavorable	28–31 23–26 17–20
	12 x 12	140–160	Favorable Average Unfavorable	23–26 19–22 14–16
	13 x 13	160–185	Favorable Average Unfavorable	20–23 16–19 12–14
	14 x 14	185–210	Favorable Average Unfavorable	17–20 14–16 11–12
	15 x 15	210–240	Favorable Average Unfavorable	15–17 12.5–14 9.5–11
	16 x 16	240–270	Favorable Average Unfavorable	13–15 11–12.5 8.5–9.5
	17 x 17	270–300	Favorable Average Unfavorable	12–13 10–11 7.5–8.5
	18 x 18	300–340	Favorable Average Unfavorable	10–12 9–10 6.5–7.5
	19 x 19	340–390	Favorable Average Unfavorable	9–10 8–9 6–6.5
	20 x 20	380–430	Favorable Average Unfavorable	8.5–9 7–8 5.5–6

HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

250-WATT DOME REFLECTOR

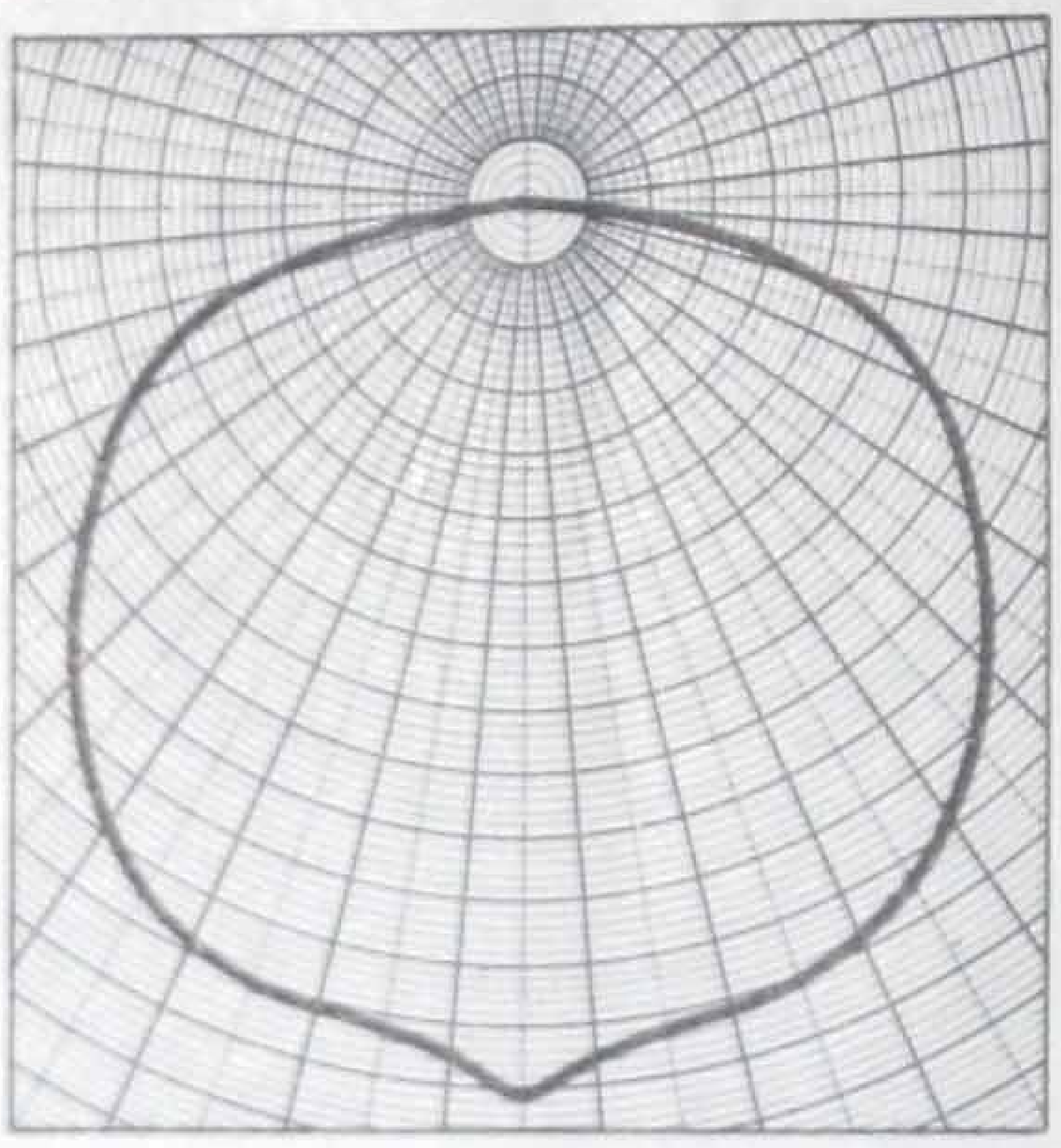
FOR LOW MOUNTING



250-Watt Dome Reflector and Glass Cover

For general industrial lighting applications where mounting heights of from 8 to 18 feet are encountered the Westinghouse Enclosed Dome Type Reflector for 250-Watt Mercury lamp should be used.

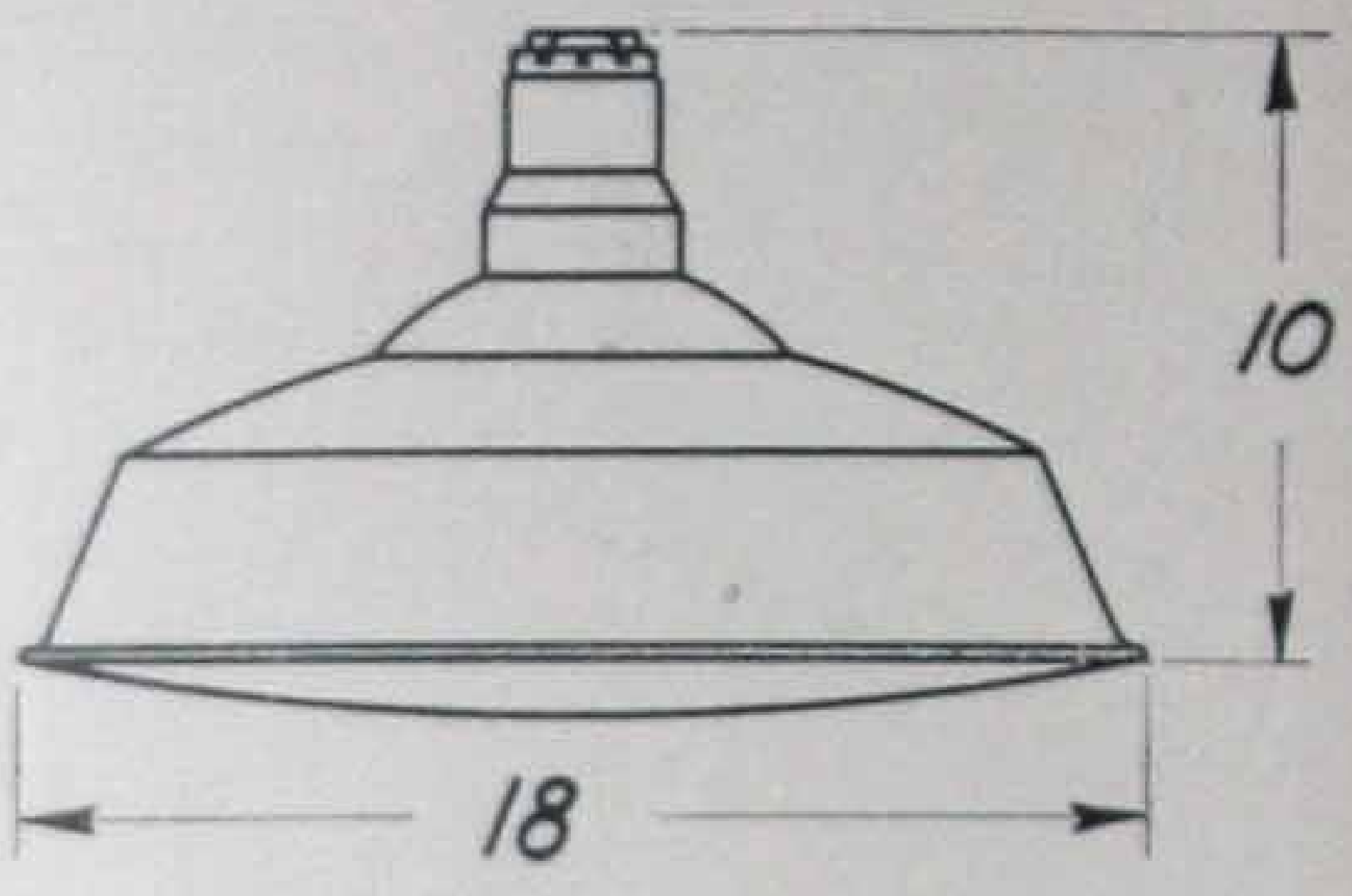
It consists of an 18″ diameter porcelain enameled dome type reflector of the RLM shape with various types of hood mountings, and a dust tight hinged glass cover. The convex lens used in the cover is acid etched on the inside and smooth on the outside. The entire assembly provides a wide uniform distribution of light so necessary for low mounting types of reflectors, and the diffusing lens minimizes the glare from the lamp.



Vertical Distribution with 250-Watt Dome Reflector

Construction

The reflector is drawn from 24 gauge iron sheet. One ground coat of porcelain enamel is applied all over, two coats white porcelain enamel inside and one green coat outside with black bead provide the reflecting surface and covering. A medium socket with high heat wax and nickel plated interior is rigidly mounted in the hood to properly locate the lamp in the reflector. Various types of hoods are available for mounting as listed below. Complete descriptions of the hoods can be found in Catalog Sections 61-140 and 61-153.



Dimensions in Inches
Dome Reflector

The glass cover is hinged directly to the reflector bead, supported at three points. It is released by unsnapping two latches. A heavy water proof felt provides a gasket between reflector and lens.

Accessories

Since the 250-watt High Intensity Mercury lamp will not operate on ordinary lighting circuits, it is necessary to provide suitable ballast equipment as described and listed on page 28.

To provide greater flexibility and ease of maintenance between the fixture and the ballast equipment, the Westinghouse Safe-Change hanger is recommended.

Mercury Lamp Size in Watts	Diameter Inches	Depth Inches	Standard Package Quantity	Standard Package Wt.	½-Inch Conduit Style No.*†	½-Inch Conduit List Price	4-Inch Outlet Box Style No.*	4-Inch Outlet Box List Price
ONE-PIECE DOME REFLECTOR COMPLETE WITH SOCKET AND HINGED COVER								
250	18	11 3/16	5	55	890 030‡	$10 40	....	... ...
ONE-PIECE DOME REFLECTOR AND SOCKET ONLY								
250	18	10	5	30	890 031	5 30	....	... ...
WEMCO QUICK-CHANGE DOME REFLECTOR COMPLETE WITH HOOD AND HINGED COVER								
250	18	11 3/16	5	55	890 032‡	10 80	890 033‡	$10 80
WEMCO QUICK-CHANGE DOME REFLECTOR ONLY								
250	18	7 1/8	5	26	890 034	4 90	890 034	4 90
WEMCO QUICK-CHANGE HOODS ONLY								
250	....	1 3/8	10	10	347 919	80	347 920	80
HINGED GLASS COVER ONLY								
250	18	....	5	23	789 314	5 10	789 314	5 10
GLASS LENS ONLY								
250	18	....	5	19	789 093	2 80	789 093	2 80

* Style numbers do not include lamps—refer to Westinghouse Lamp Company or its agents.

† ¾-inch can be furnished when specified.

‡ If clear lens is desired order similar to above Complete Unit styles except with clear lens. Deduct $1.00 from List Price.

See pages 28 through 32 for ballast and accessory equipment.

HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

250-WATT DOME REFLECTOR

FOR LOW MOUNTING

Conduit Mounting
One Piece Reflector

Conduit Mounting
Wemco Quick-Change
Cast Aluminum Hood

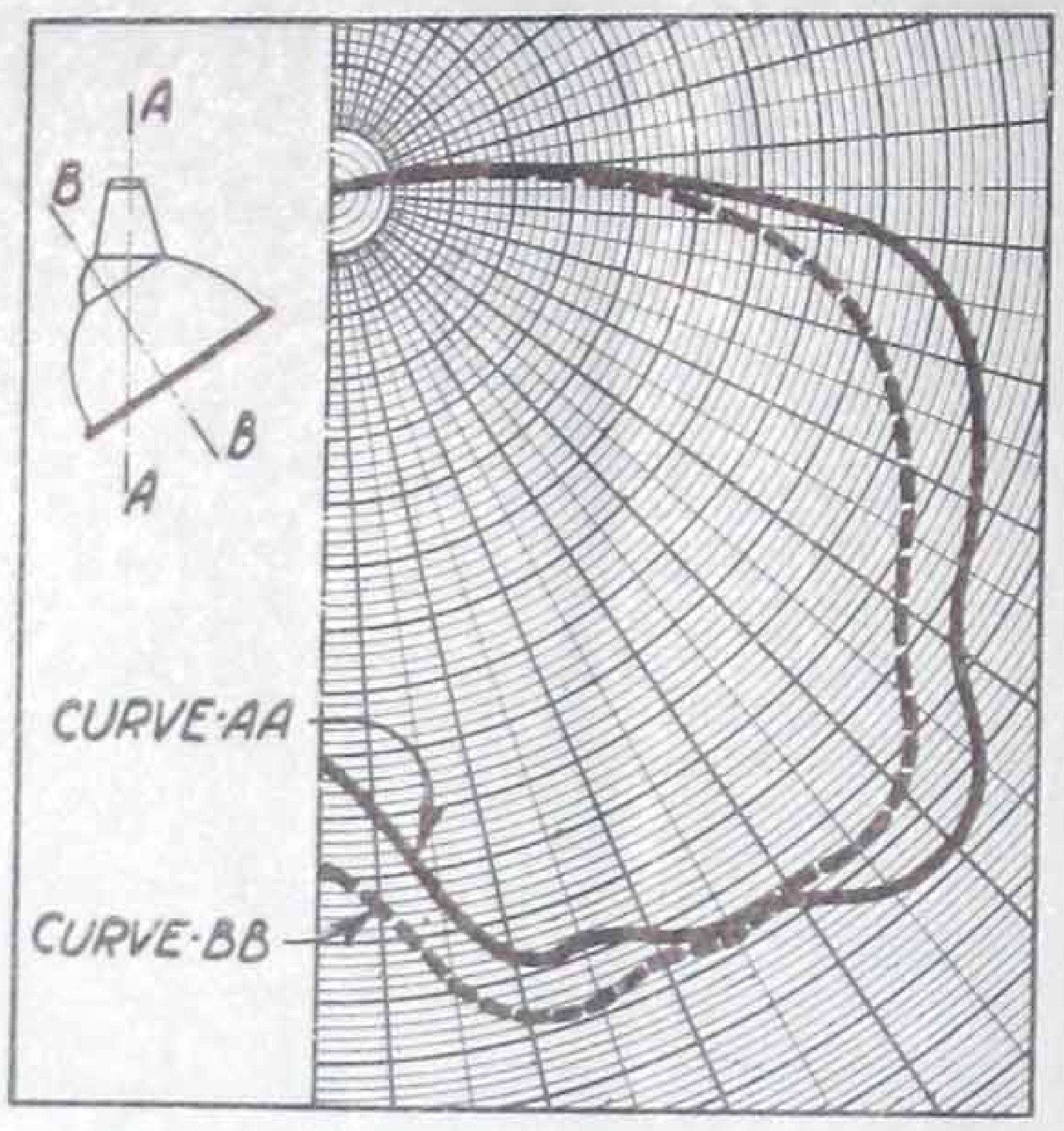
Outlet Box Mounting
Wemco Quick-Change
Cast Aluminum Hood

Distance from Underside of Reflector to Floor to be Not less than (Feet)	Approximate Spacing (Feet)	Area per Outlet (Sq. Ft.)	Conditions Factor	Average Footcandles 250-Watt
7½	7¾ x 7¾	55–65	Favorable Average Unfavorable	40–52 30–40 24–31
8½	8½ x 8½	65–75	Favorable Average Unfavorable	34–42 25–34 20–25
8½	9 x 9	75–85	Favorable Average Unfavorable	30–38 22–29 18–22
9	9½ x 9½	85–95	Favorable Average Unfavorable	27–34 20–27 16–20
9½	10 x 10	95–110	Favorable Average Unfavorable	25–32 18–25 16–18
10	11 x 11	110–125	Favorable Average Unfavorable	21–27 16–21 13–16
10½	11½ x 11½	125–145	Favorable Average Unfavorable	18–24 14–18 11–14
11½	12½ x 12½	145–170	Favorable Average Unfavorable	17–21 13–17 10–13
11½	13½ x 13½	170–200	Favorable Average Unfavorable	14–17 10–14 9–10.5
12½	14¾ x 14¾	200–230	Favorable Average Unfavorable	11–14 9–11 7.5–9
13	15½ x 15½	230–260	Favorable Average Unfavorable	10.5–12.5 8.5–10 6–7.5
13½	16¾ x 16¾	260–300	Favorable Average Unfavorable	10–11 7–8.5 5.5–6.5
14½	18 x 18	300–340	Favorable Average Unfavorable	7–10 5.5–7 5–5.5
15½	19 x 19	340–390	Favorable Average Unfavorable	6.5–8.5 5–5.5 4–5
16½	20½ x 20½	390–440	Favorable Average Unfavorable	5.5–7 4–5.5 3.5–4
17	21¾ x 21¾	440–500	Favorable Average Unfavorable	5–5.5 3.5–5 3–3.5

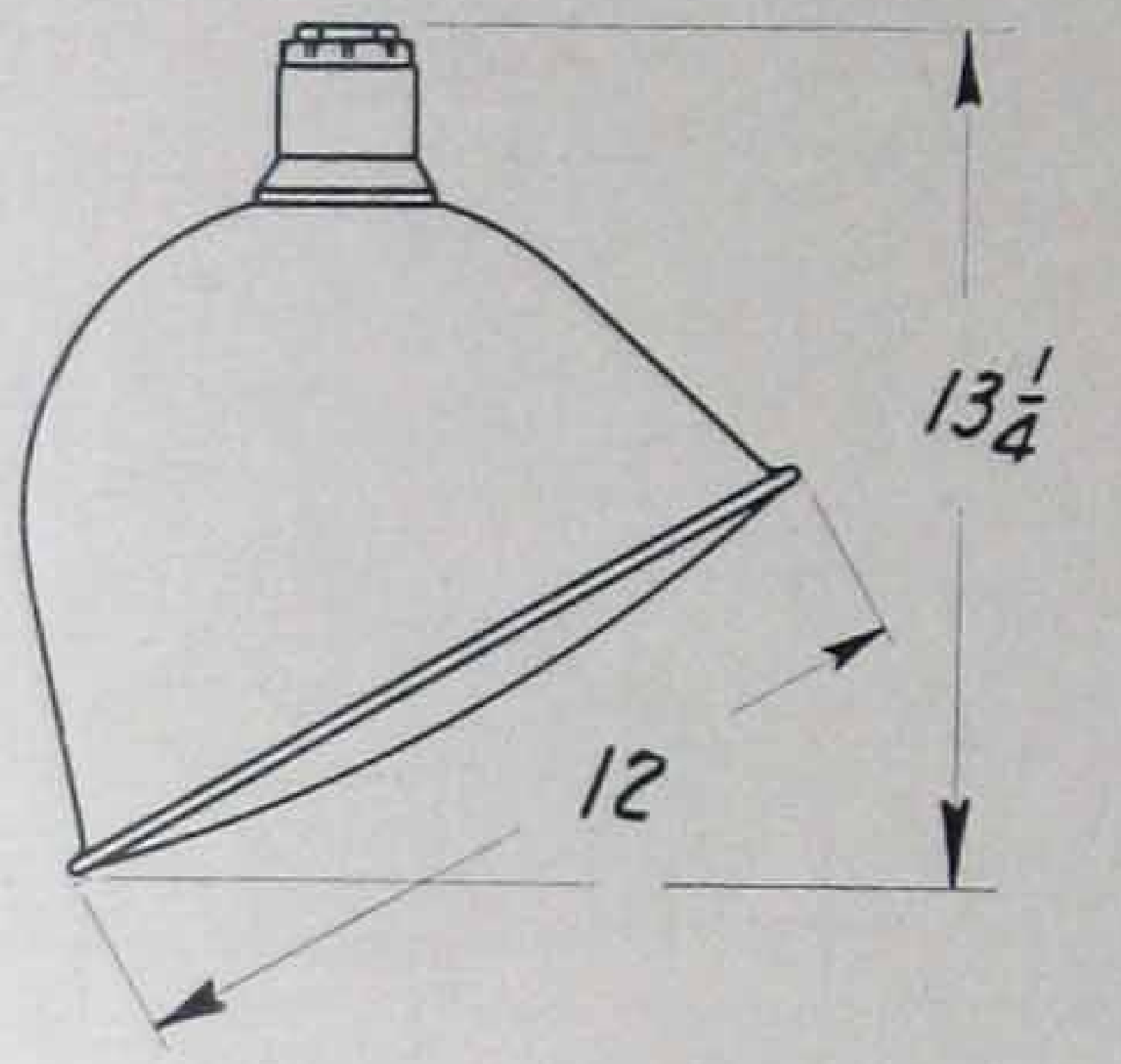
HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

250-WATT SYMMETRICAL ANGLE REFLECTOR

250-Watt Symmetrical Angle Reflector and Glass Cover



Vertical Distribution with 250-Watt Symmetrical Angle Reflector



Dimensions in Inches Symmetrical Angle Reflector

This unit is designed especially for the 250-watt High Intensity Mercury lamp. It provides ideal illumination where intensive local lighting of vertical and horizontal surfaces from the side is required.

The reflector, with diffusing glass cover, is properly designed to give a wide spread distribution of light horizontally, and an even distribution of light from top to bottom of the vertical surface. It is a 30° angle reflector and provides distribution as shown by the curves.

Various types of hoods are available for mounting such as One-Piece and Wemco Quick-Change, arranged to mount on ½″ conduit, 4″ outlet box, and side outlet hood for ½″ conduit. Complete descriptions of the applicable hoods can be found in Catalog Sections 61-140 and 61-153.

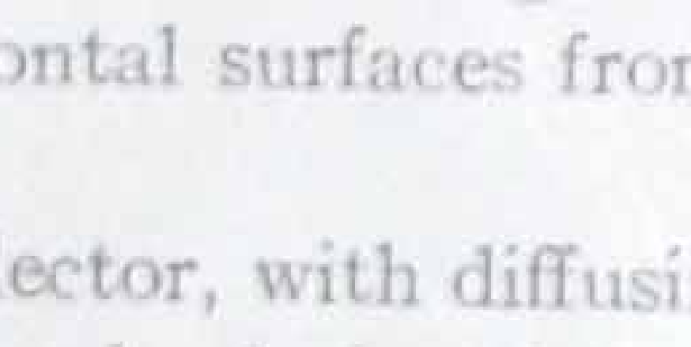
Construction

The reflector is drawn from 24 gauge iron sheet. One ground coat of porcelain enamel is applied all over and two coats of white porcelain enamel inside and one green coat outside with black bead provide the reflecting surface and covering.

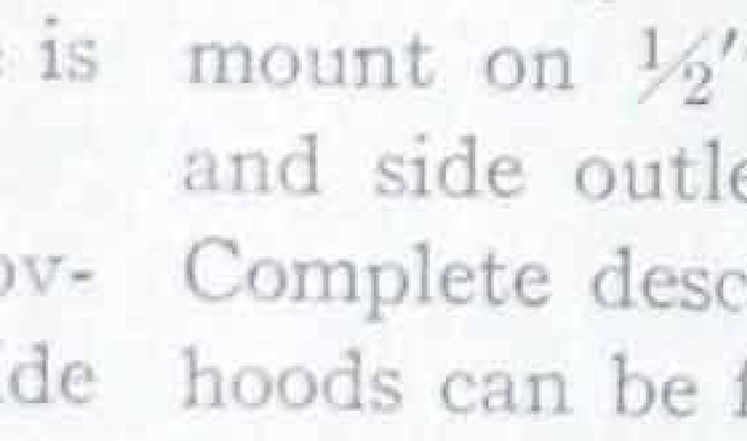
The acid etched glass cover is hinged directly to the reflector bead, supported at three points. It is released by unsnapping two latches. A heavy waterproof felt provides a gasket between reflector and lens.

Accessories

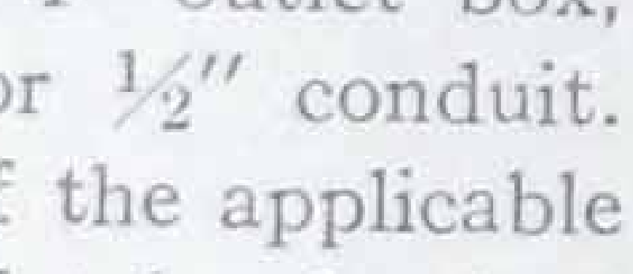
Since the 250-watt High Intensity Mercury lamp will not operate on ordinary lighting circuits, it is necessary to provide suitable current limiting accessories as described and listed on Page 28.



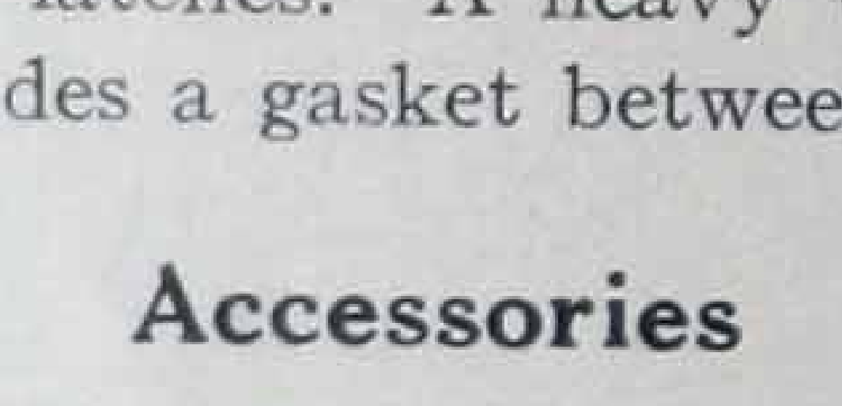
Conduit Mounting One Piece Reflector



Conduit Mounting Wemco Quick-Change Cast Aluminum Hood



Outlet Box Mounting Wemco Quick-Change Cast Aluminum Hood



Side Mounting Wemco Quick-Change Cast Aluminum Hood

Mercury Lamp Size in Watts	Diameter Inches	Depth Inches	Standard Package		½-Inch Conduit		4-Inch Outlet Box		½-Inch Side Outlet	
			Quantity	Wt.	Style No.*†	List Price	Style No.*	List Price	Style No.*†	List Price
ONE-PIECE SYMMETRICAL ANGLE REFLECTOR COMPLETE WITH SOCKET AND HINGED COVER										
250	12	13¼	5	35	890 037**	$9 05	....	.....	....	.....
ONE-PIECE SYMMETRICAL ANGLE REFLECTOR AND SOCKET ONLY										
...	12	13¼	5	23	890 038	4 95	....	.....	....	.....
WEMCO QUICK-CHANGE SYMMETRICAL ANGLE REFLECTOR COMPLETE WITH HOOD AND HINGED COVER										
250	12	13⅝	5	35	890 039**	9 45	890 040**	$9 45	890 057**	$9 45
WEMCO QUICK-CHANGE SYMMETRICAL ANGLE REFLECTOR ONLY										
250	12	11⅝	5	20	890 041	4 55	890 041	4 55	890 041	4 55
WEMCO QUICK-CHANGE HOODS ONLY										
250	..	1⅞	10	10	347 919	80	347 920	80	347 923	80
HINGED GLASS COVER ONLY										
250	12	...	5	12	890 042	4 10	890 042	4 10	890 042	4 10
GLASS LENS ONLY										
250	12	...	5	8	890 071	2 20	890 071	2 20	890 071	2 20

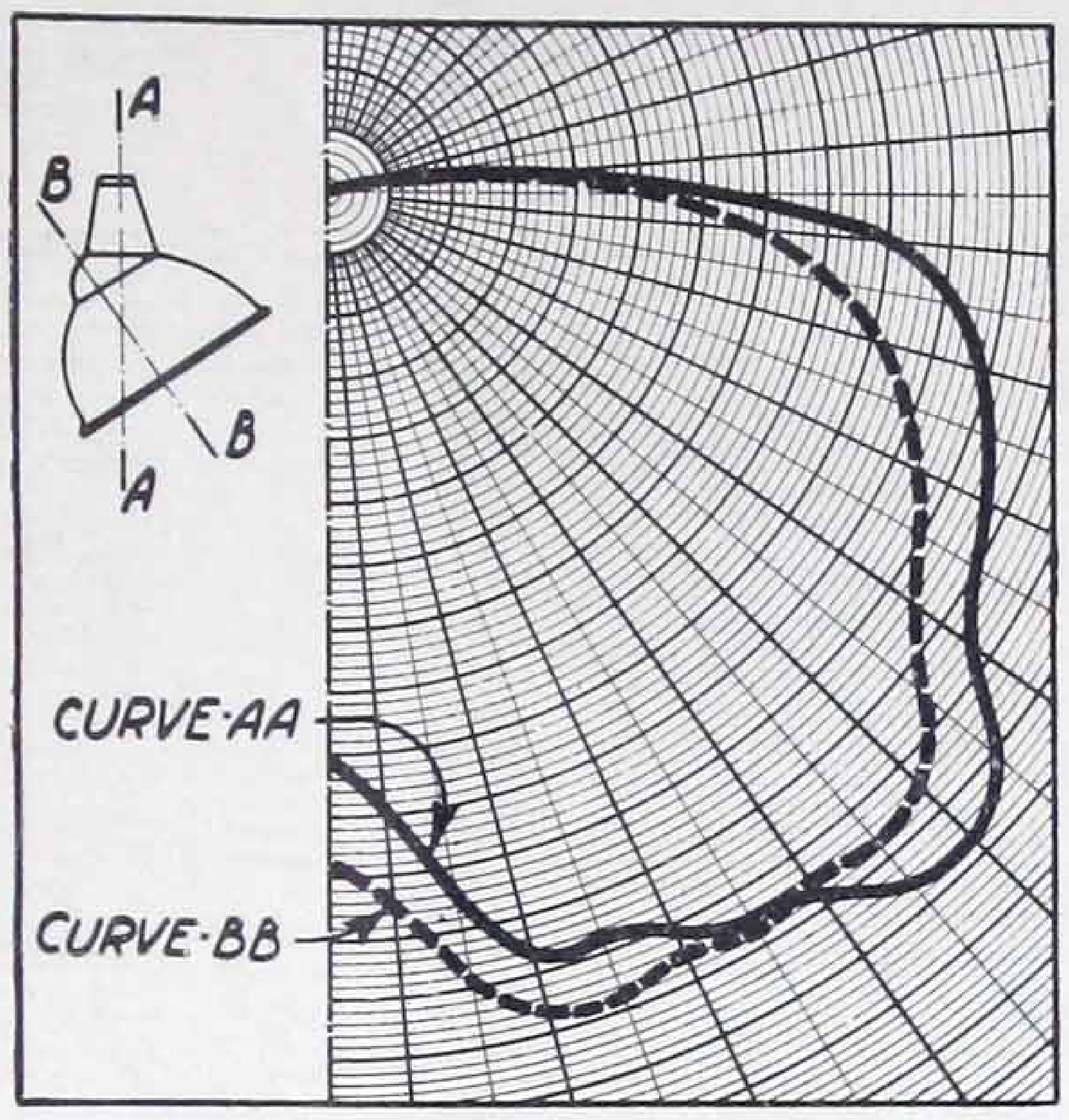
* Style numbers do not include lamps—refer to Westinghouse Lamp Company or its agents.
† ¾-inch can be furnished when specified.
** If clear lens is desired order similar to above complete unit styles except with clear lens. Deduct $1.00 from List Price.

See pages 28 through 32 for ballast and accessory equipment.

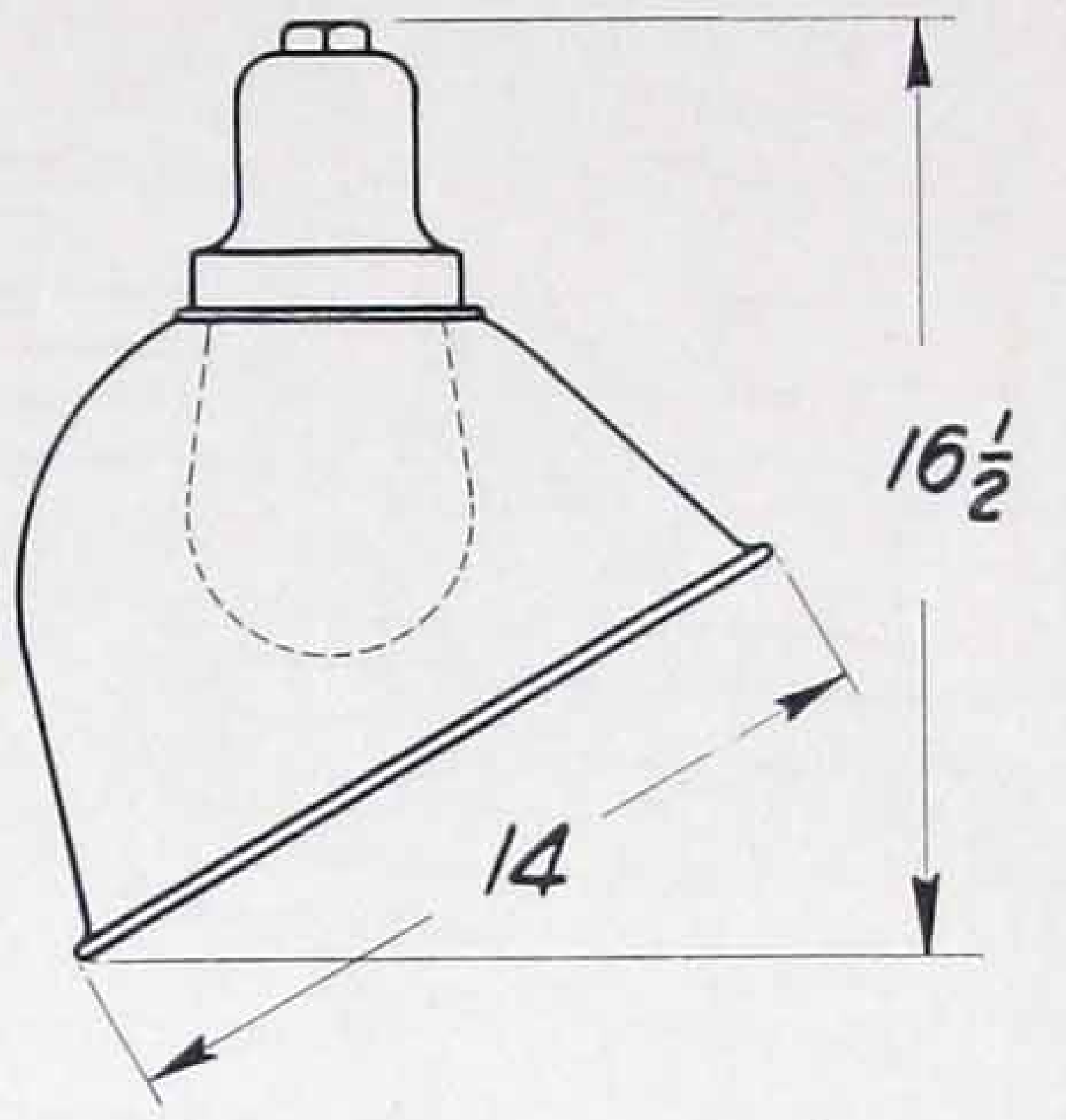
HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

250-WATT VAPOR PROOF ANGLE REFLECTOR

50-Watt Vapor Proof Angle Reflector and Globe



Vertical Distribution with 250-Watt Vapor Proof Angle Reflector



Dimensions in Inches
Vapor Proof Angle Reflector

Westinghouse Angle Type Vapor Proof units for the 250-watt High Intensity Mercury lamp are designed for severe service conditions such as locations where excessive moisture and non-combustible dust are present. In locations with overhead obstructions, these units, mounted on the side walls, provide good illumination on horizontal or vertical surfaces.

The complete unit consists of a cast iron hood with medium socket, an opal glass globe and a porcelain enamel reflector.

Conduit Mounting
Cast-Iron Hood

Construction

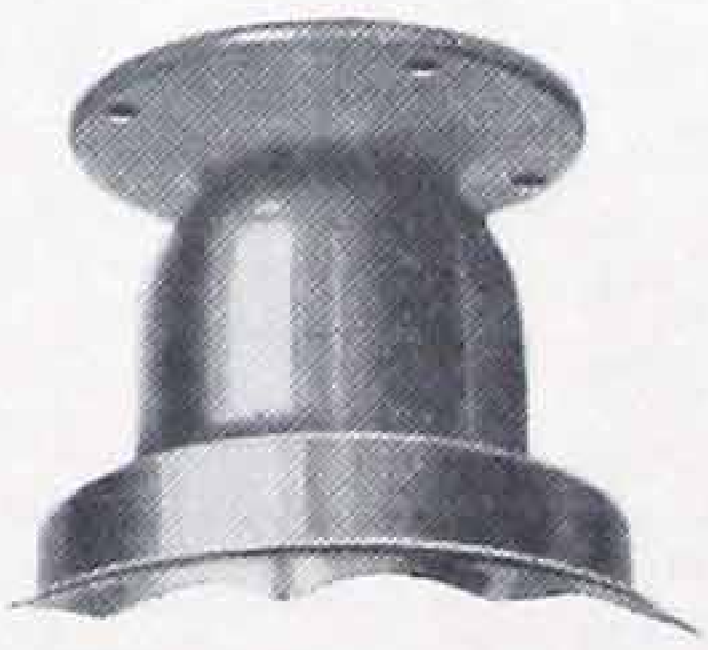
The hood or socket housing is of heavy cast iron tapped for ½″ conduit, or arranged with an outlet box cover for direct attachment to Westinghouse Vapor Proof Box, Style No. 336961. It will also attach directly to a standard 4″ sheet metal outlet box and still retain its vapor proof properties as the outlet box type is vapor proof regardless of whether or not it is connected to a vapor proof conduit box.

The hoods are finished in green, baked, acid resisting enamel. A medium base front connected socket is rigidly mounted in the hood and properly positions the lamp in the globe and reflector. The hood and globe are threaded, and gaskets are provided for the vapor proof enclosing globe.

The reflector is drawn from iron sheet, and finished with one ground coat of porcelain enamel all over, two coats of stainless white porcelain enamel inside, and one green coat outside with black bead. A special aluminum gasket completes the joint between the reflector and hood, and eliminates the possibility of chipped enamel at the points of contact.

Accessories

Since the 250-watt High Intensity Mercury lamp will not operate on ordinary lighting circuits, it is necessary to provide ballast equipment as described and listed on page 28.



Outlet Box Mounting
Cast-Iron Hood

Mercury Lamp Size in Watts	Diameter Inches	Depth Inches	Standard Package		½-Inch Conduit		4-Inch Outlet Box	
			Quantity	Wt.	Style No.*†	List Price	Style No.*	List Price
VAPOR PROOF ANGLE REFLECTOR COMPLETE								
250	14	16½	5	55	890 044**	$10 75	890 045**	$11 45
VAPOR PROOF ANGLE REFLECTOR ONLY								
250	14	11½	5	20	890 046	4 40	890 046	4 40
VAPOR PROOF HOODS ONLY								
...	....	5	10	40	890 047	4 00	890 048	4 70
VAPOR PROOF GLOBE ONLY								
...	5	6	10	30	890 065	2 35	890 065	2 35

* Style numbers do not include lamps—refer to Westinghouse Lamp Company or its agents.
† ¾-inch can be furnished when specified.
** If clear globe or heat resisting globe is desired order similar to above complete unit styles except with clear globe or heat resisting globe. Deduct $ .75 from List for Clear Globe. Add $1.25 to List for Heat Resisting Globe.

See pages 28 through 32 for ballast and accessory equipment.

HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

250-WATT VAPOR PROOF DOME REFLECTOR

FOR LOW MOUNTING

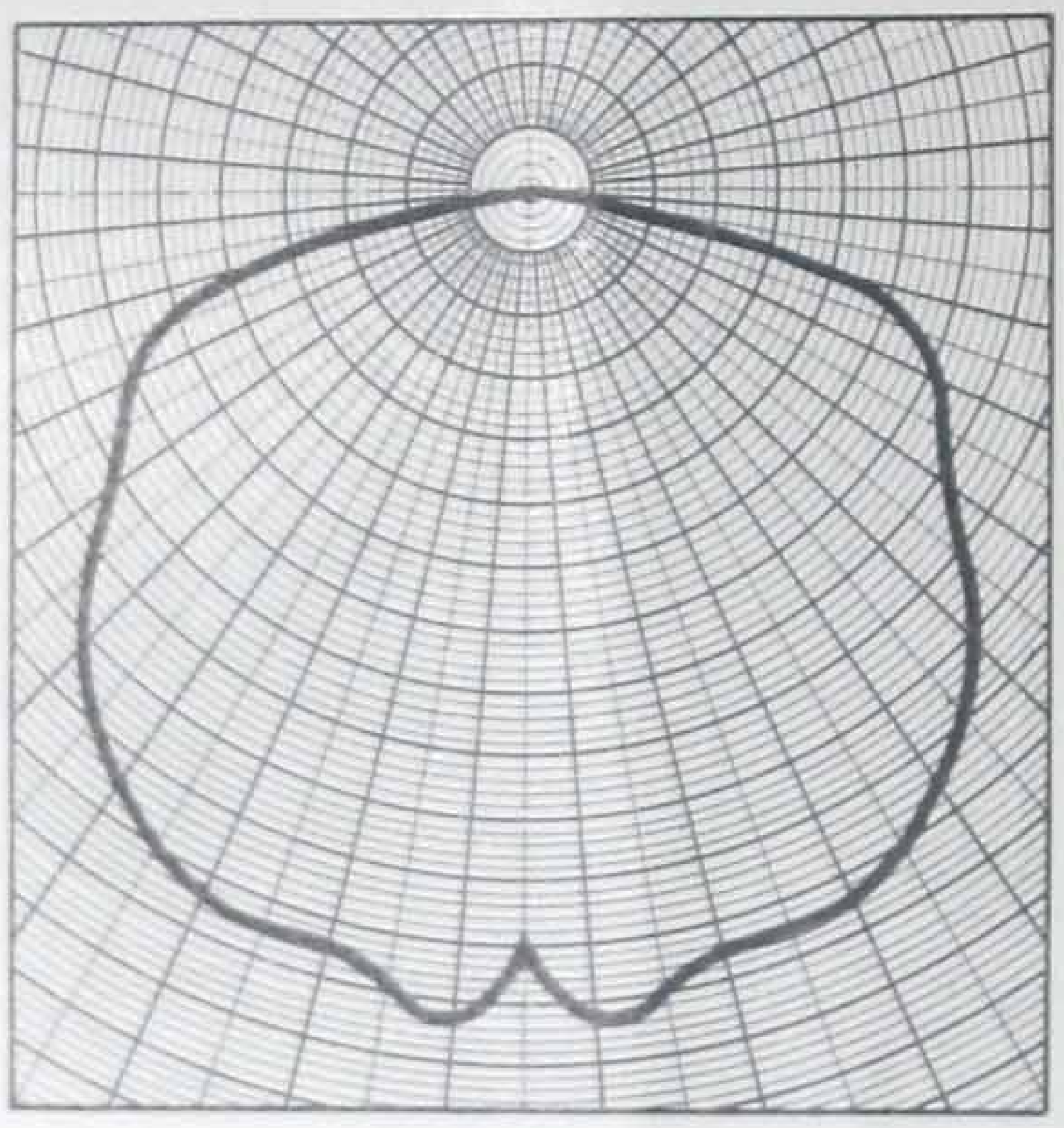
250-Watt Vapor Proof Dome Reflector and Globe

Westinghouse Dome Type Vapor Proof units for the 250-watt High Intensity Mercury lamp are designed for severe service conditions such as locations where excessive moisture and noncombustible dust are present. For good general illumination with these units, proper mounting heights and spacings are given on the opposite page.

The complete unit consists of a cast iron hood with medium socket, an opal glass globe and a porcelain enamel reflector.

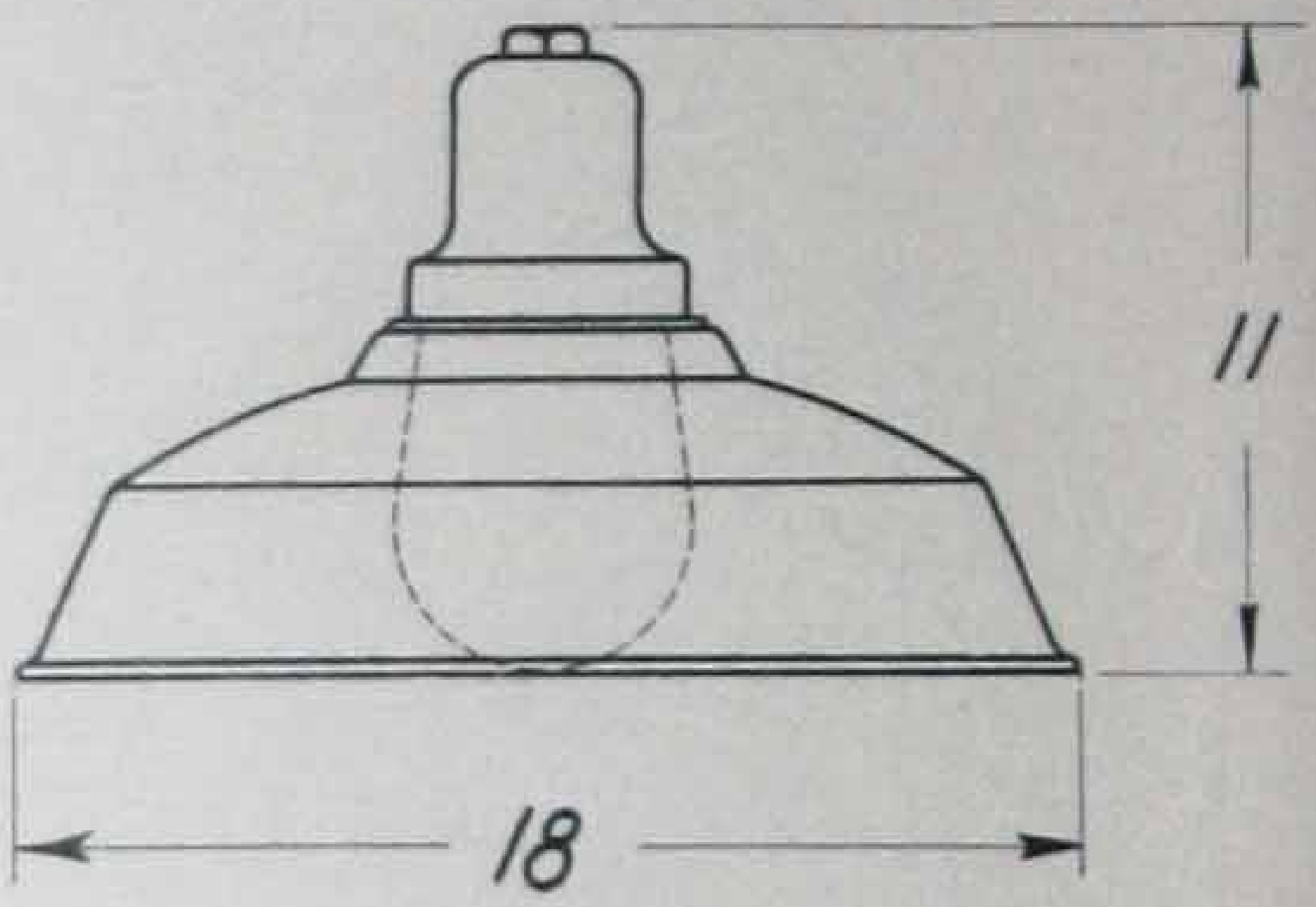
Construction

The hood or socket housing is of heavy cast iron tapped for ½″ conduit, or arranged with an outlet box cover for direct attachment to Westinghouse Vapor Proof Box, Style No. 336961. It will also attach directly to a standard 4″ sheet metal outlet box and still retain its vapor proof properties as the outlet box type is vapor proof regardless of whether or not it is connected to a vapor proof conduit box.



Vertical Distribution with 250-Watt Vapor Proof Dome Reflector

The hoods are finished in green, baked, acid resisting enamel. A medium base front connected socket is rigidly mounted in the hood and properly positions the lamp in the globe and reflector. The hood and globe are threaded, and gaskets are provided for the vapor proof enclosing globe.



Dimensions in Inches
Vapor Proof Dome Reflector

The reflector is drawn from iron sheet, and finished with one ground coat of porcelain enamel all over, two coats of stainless white porcelain enamel inside, and one green coat outside with black bead. A special aluminum gasket completes the joint between the reflector and hood, and eliminates the possibility of chipped enamel at the points of contact.

Accessories

Since the 250-watt High Intensity Mercury lamp will not operate on ordinary lighting circuits, it is necessary to provide suitable ballast equipment as described and listed on page 28.

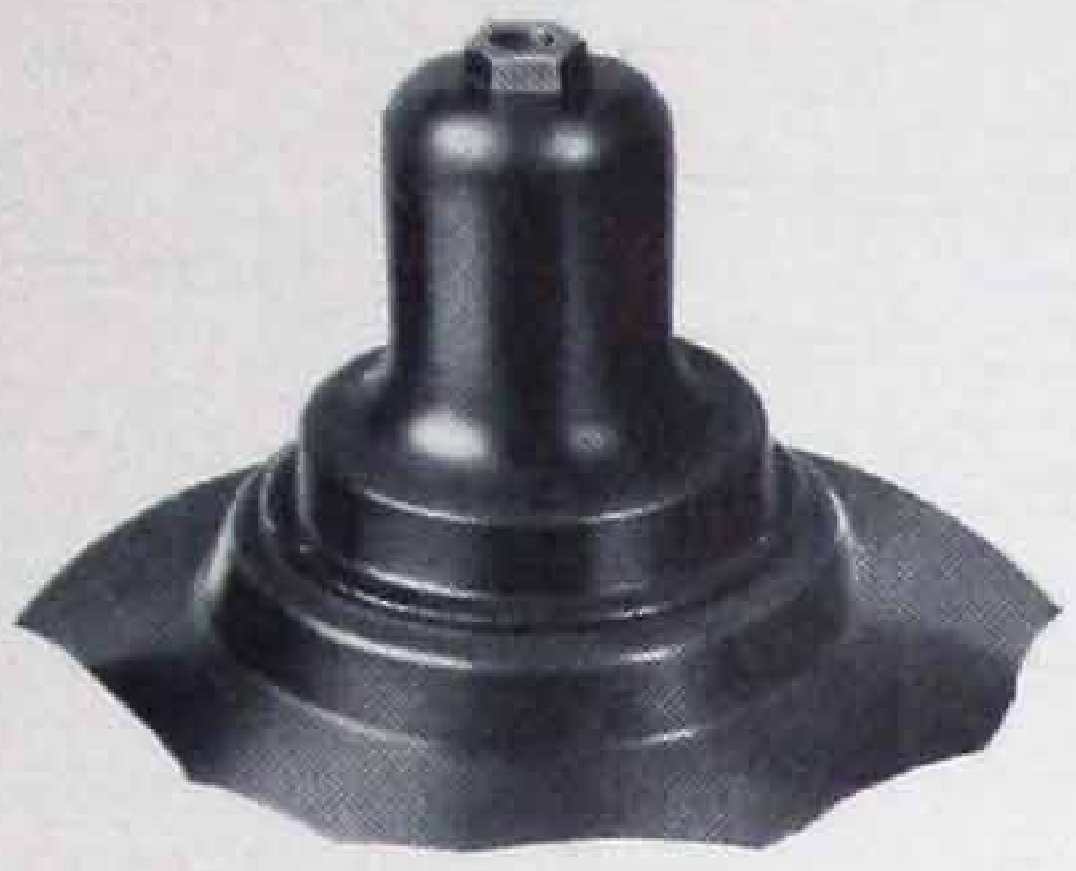
Mercury Lamp Size in Watts	Diameter Inches	Depth Inches	Standard Package Quantity	Standard Package Wt.	½-Inch Conduit Style No.*†	½-Inch Conduit List Price	4-Inch Outlet Box Style No.*	4-Inch Outlet Box List Price
VAPOR PROOF DOME REFLECTOR COMPLETE								
250	18	11	5	60	890 049**	$11 50	890 050**	$12 20
VAPOR PROOF DOME REFLECTOR ONLY								
250	18	5⅞	5	25	890 051	5 15	890 051	5 15
VAPOR PROOF HOODS ONLY								
250	....	5	10	40	890 047	4 00	890 048	4 70
VAPOR PROOF GLOBE ONLY								
250	5	6	10	30	890 065	2 35	890 065	2 35

* Style numbers do not include lamps—refer to Westinghouse Lamp Company or its agents.
† ¾-inch can be furnished when specified.
** If clear globe or heat resisting globe is desired order similar to above complete unit styles except with clear glass or heat resisting globe. Deduct $.75 from List for Clear Globe. Add $1.25 to List for Heat Resisting Globe.
See pages 28 through 32 for ballast and accessory equipment.

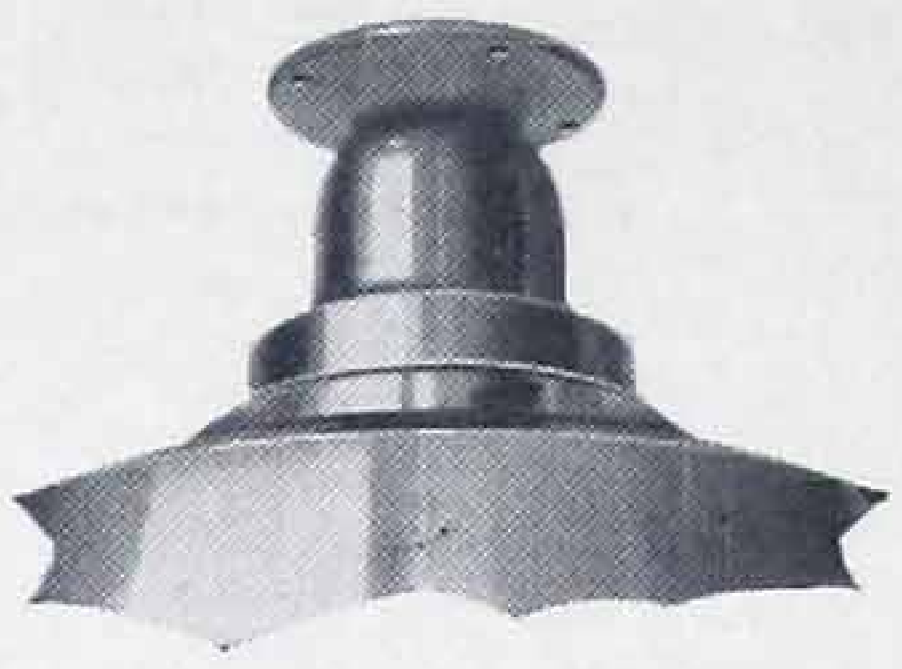
HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

250-WATT VAPOR PROOF DOME REFLECTORS

FOR LOW MOUNTING



Conduit Mounting
Cast-Iron Hood

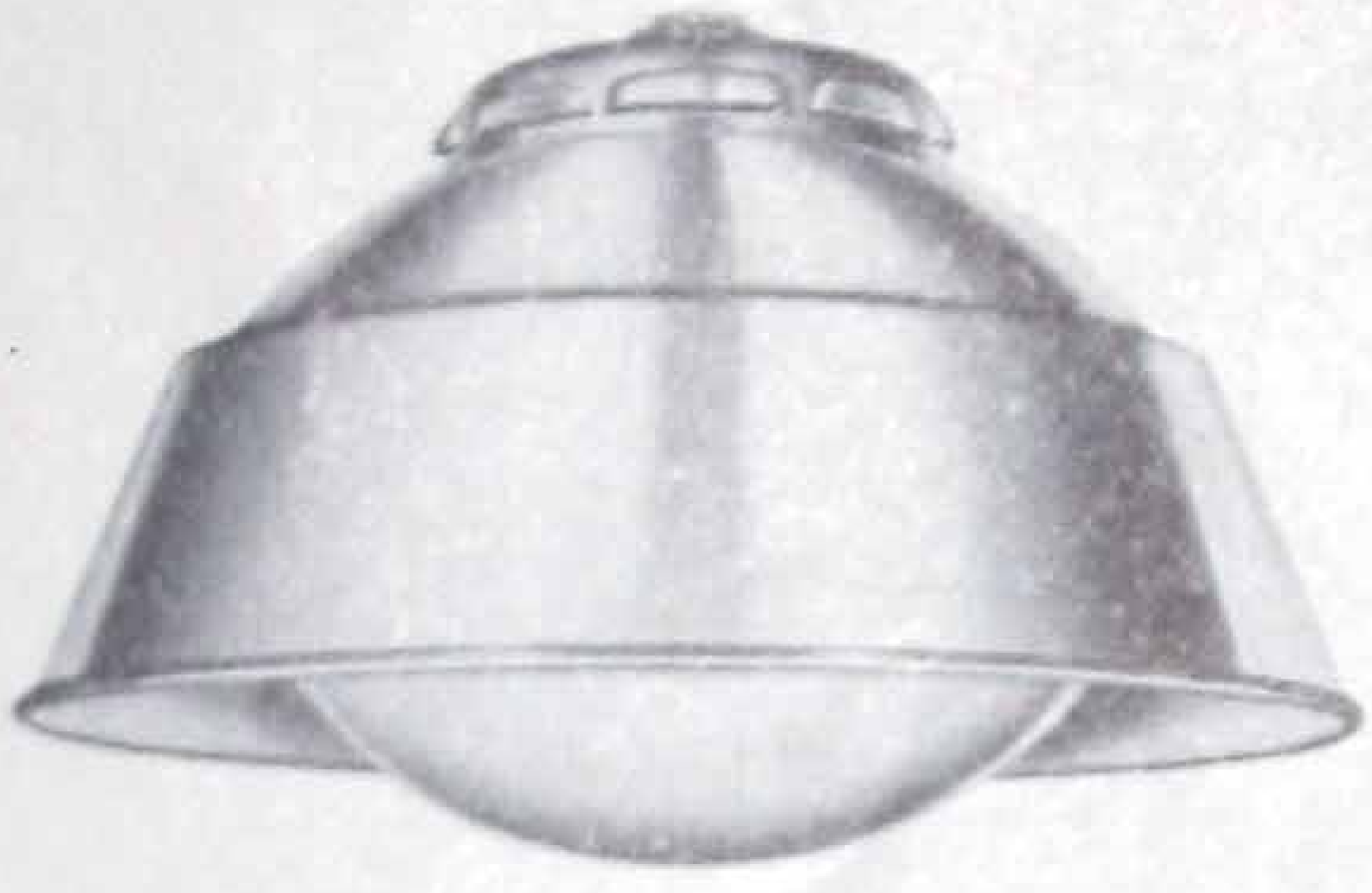


Outlet Box Mounting
Cast-Iron Hood

Distance from Underside of Reflector to Floor to be Not less than (Feet)	Approximate Spacing (Feet)	Area per Outlet (Sq. Ft.)	Conditions Factor	Average Footcandles 250-Watt
7½	7¾ x 7¾	55–65	Favorable Average Unfavorable	40–52 30–40 24–31
8½	8½ x 8½	65–75	Favorable Average Unfavorable	34–42 25–34 20–25
8½	9 x 9	75–85	Favorable Average Unfavorable	30–38 22–29 18–22
9	9½ x 9½	85–95	Favorable Average Unfavorable	27–34 20–27 16–20
9½	10 x 10	95–110	Favorable Average Unfavorable	25–32 18–25 16–18
10	11 x 11	110–125	Favorable Average Unfavorable	21–27 16–21 13–16
10½	11½ x 11½	125–145	Favorable Average Unfavorable	18–24 14–18 11–14
11½	12½ x 12½	145–170	Favorable Average Unfavorable	17–21 13–17 10–13
11½	13½ x 13½	170–200	Favorable Average Unfavorable	14–17 10–14 9–10.5
12½	14¾ x 14¾	200–230	Favorable Average Unfavorable	11–14 9–11 7.5–9
13	15½ x 15½	230–260	Favorable Average Unfavorable	10.5–12.5 8.5–10 6–7.5
13½	16¾ x 16¾	260–300	Favorable Average Unfavorable	10–11 7–8.5 5.5–6.5
14½	18 x 18	300–340	Favorable Average Unfavorable	7–10 5.5–7 5–5.5
15½	19 x 19	340–390	Favorable Average Unfavorable	6.5–8.5 5–5.5 4–5
16½	20½ x 20½	390–440	Favorable Average Unfavorable	5.5–7 4–5.5 3.5–4
17	21¾ x 21¾	440–500	Favorable Average Unfavorable	5–5.5 3.5–5 3–3.5

HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

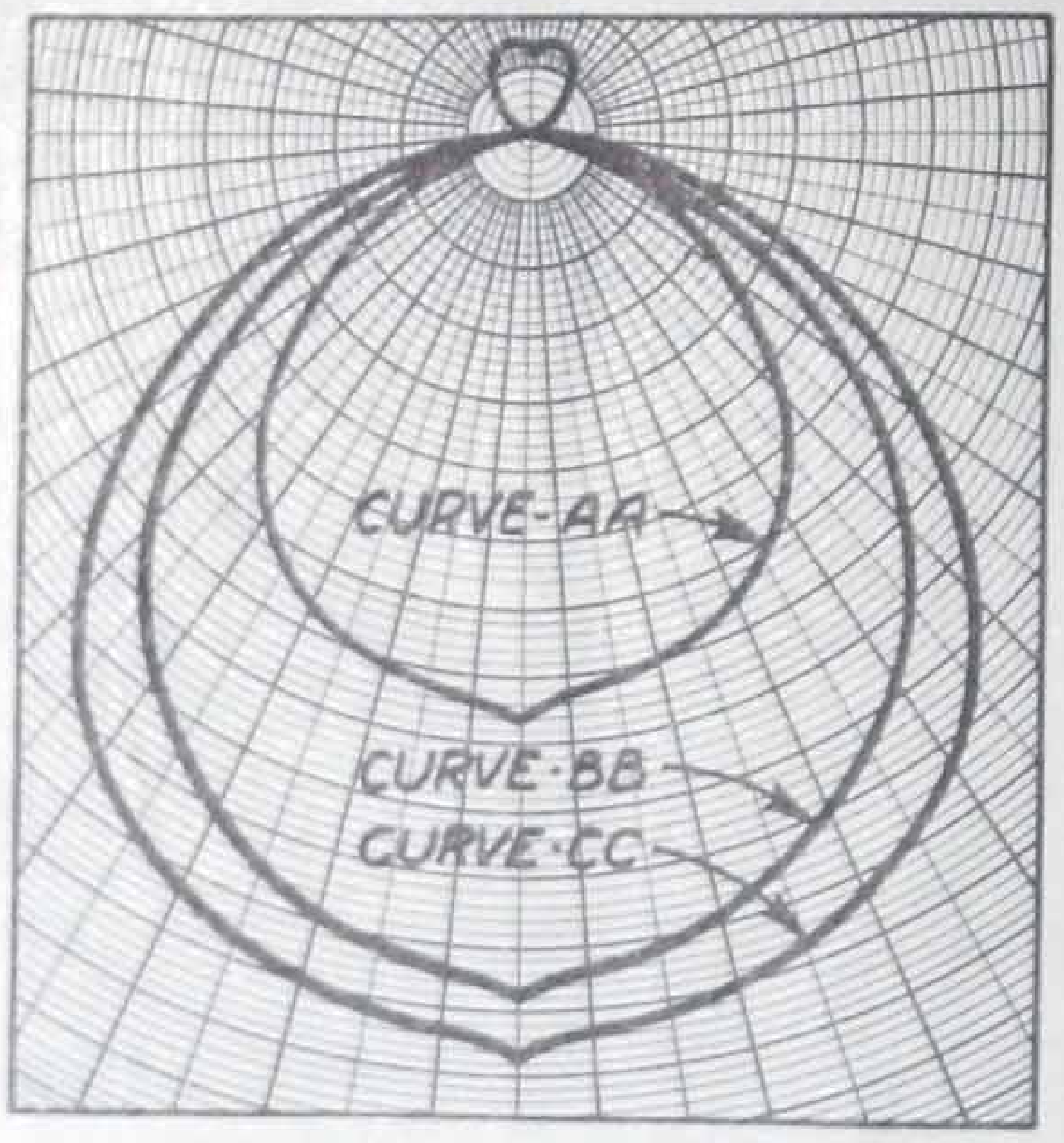
250 WATT COMBINATION UNIT FOR MERCURY AND INCANDESCENT LAMPS



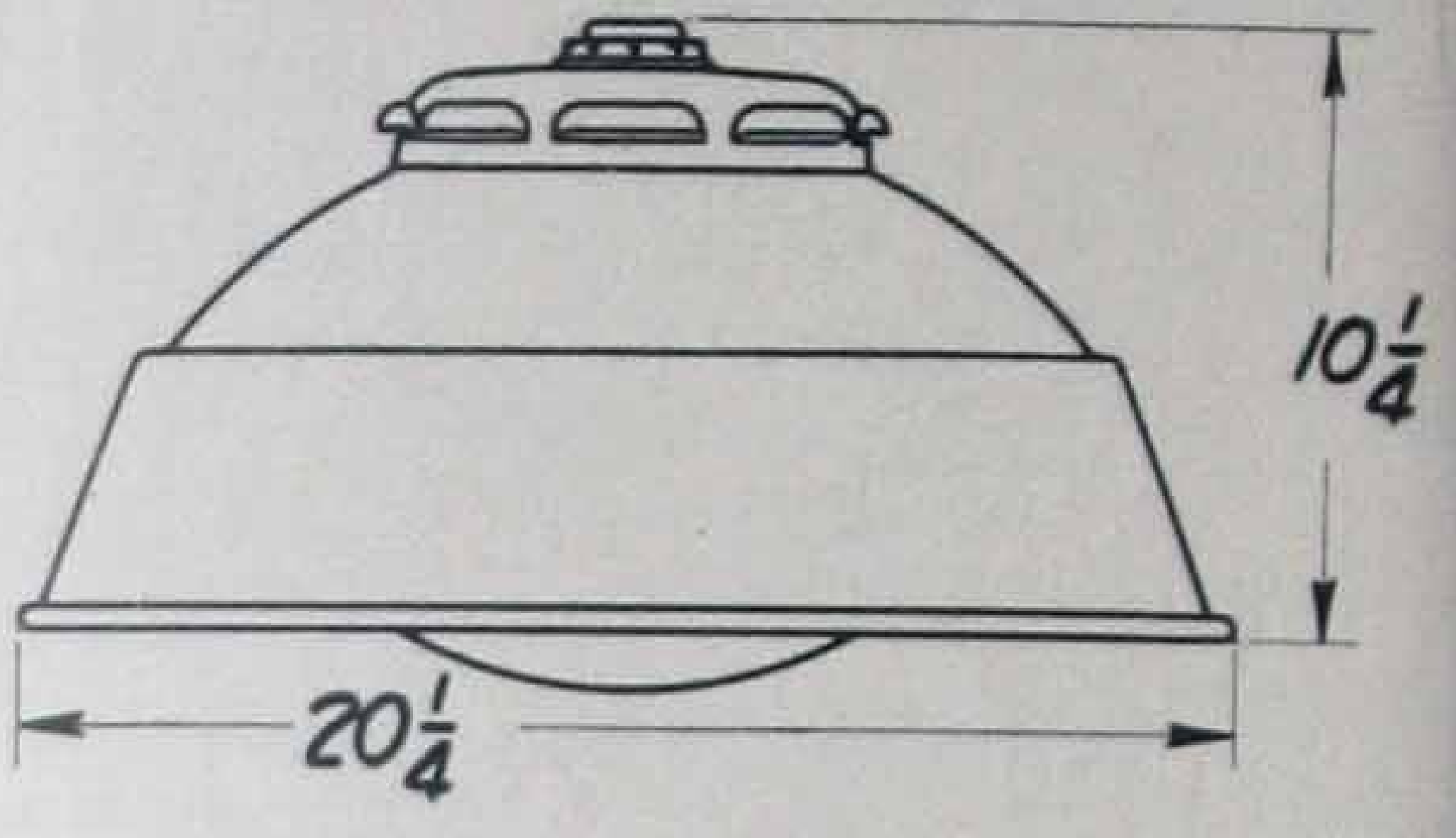
250-Watt Combination Unit
For Mercury and Incandescent Lamps

For various applications of Industrial lighting where color correction is necessary, the Westinghouse Combination unit effectively and efficiently mixes the light lumens of the 250-Watt High Intensity Mercury lamp with a quantity of light lumens from ordinary incandescent lamps. It is designed for use on mounting heights of 8 to 18 feet. The spacing should not exceed 1¼ times the mounting height.

Two distinct circuits are used, one to control the mercury lamp and one to control the incandescent lamps. The design is such as to allow three 60-watt, three 75-watt or three 100-watt incandescent lamps to be used without interfering with the restarting of the Mercury lamp in case of a voltage interruption. Three 150-watt lamps may be used but the operating temperature will be too high to permit restarting of the Mercury lamp with the incandescent lamps burning.



Vertical Distribution with 250-Watt Combination Unit. Curve A-A 250-Watt Mercury Lamp Only. Curve B-B 1—250-Watt Mercury Lamp and 3—75-Watt Incandescent Lamps. Curve C-C 1—250-Watt Mercury Lamp and 3—100-Watt Incandescent Lamps.



Dimensions in Inches
250-Watt Combination Unit

Construction

The unit consists of an aluminum reflector, with socket assembly and a monax diffusing hinged glass bowl.

The reflector is made from 14 gauge commercially pure etching grade aluminum sheet. The entire surface is finished by the Alzak process for greater permanence and ease of cleaning.

The entire socket assembly which consists of three medium sockets for the incandescent lamps and one socket for the Mercury lamp is attached to the top of the reflector. A slip type louvered cover provides sufficient ventilation for the sockets and allows for wiring or inspection of wiring after the reflector is in position. It is arranged for mounting on ½″ conduit. The diffusing bowl is banded at the fitter and hinged in the reflector. A felt gasket provides a suitable joint between the glass and the reflector. The entire assembly is simple to wire and the hinged glass bowl provides for quick and easy access to the lamps, and eliminates the hazard of removing large globes. Sufficient ventilation is provided to keep the temperature within safe operating limits.

Accessories

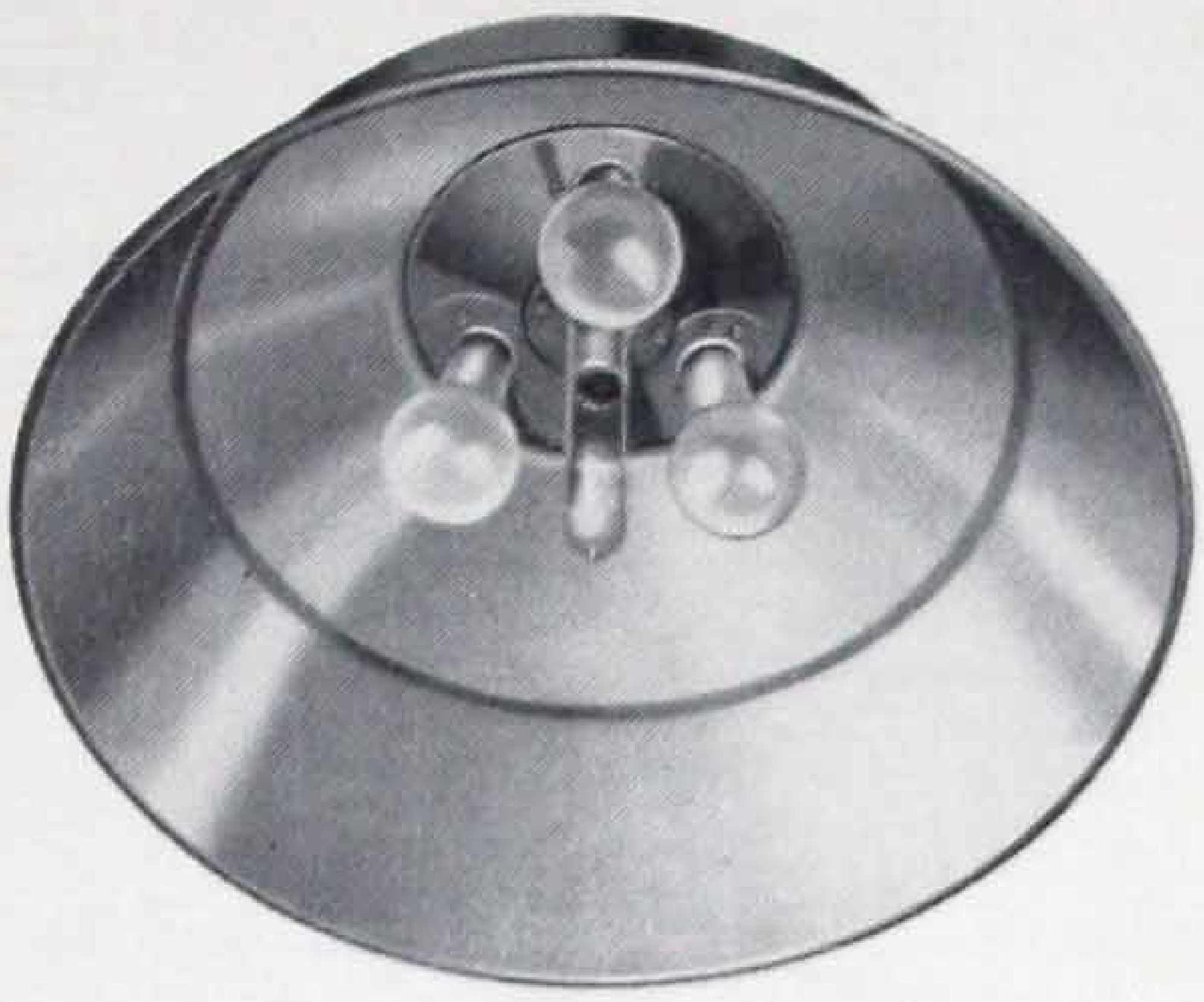
Since the 250-watt High Intensity Mercury lamp will not operate on ordinary lighting circuits, it is necessary to provide suitable ballast equipment as described and listed on page 28.

Recommended Lamp Size in Watts	Diameter Inches	Depth Inches	Standard Package Quantity	Standard Package Wt.	½-Inch Conduit Style No.*†	½-Inch Conduit List Price
250-WATT COMBINATION UNIT COMPLETE WITH GLASS BOWL						
1—250-watt Mercury 3—100-watt Incandescent	20¼	12⅜	1	25	890 054	$21 00
250-WATT COMBINATION UNIT ONLY						
1—250-watt Mercury 3—100-watt Incandescent	20¼	10¼	1	17	890 055	16 20
GLASS BOWL ONLY						
1—250-watt Mercury 3—100-watt Incandescent	16	5½	1	8	890 056	4 80

* Style numbers do not include lamps—refer to Westinghouse Lamp Company or its agents.
† ¾-inch can be furnished when specified.
See pages 28 through 32 for ballast and accessory equipment.

HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

250-WATT COMBINATION UNIT FOR MERCURY AND INCANDESCENT LAMPS



Lamp Arrangement. 250-Watt Combination Unit For Mercury and Incandescent Lamps

Distance from Underside of Reflector to Floor to be Not less than (Feet)	Approximate Spacing (Feet)	Area per Outlet (Sq. Ft.)	Conditions Factor	Average Footcandles 250-Watt Mercury 3—100-Watt Incandescent
7½	7¾ x 7¾	55–65	Favorable Average Unfavorable	62–80 48–60 36–48
8½	8½ x 8½	65–75	Favorable Average Unfavorable	53–66 39–49 30–39
8½	9 x 9	75–85	Favorable Average Unfavorable	46–60 35–46 28–35
9	9½ x 9½	85–95	Favorable Average Unfavorable	41–53 30–43 24–30
9½	10 x 10	95–110	Favorable Average Unfavorable	38–50 28–39 24–28
10	11 x 11	110–125	Favorable Average Unfavorable	33–41 24–33 20–24
10½	11½ x 11½	125–145	Favorable Average Unfavorable	28–37 22–28 17–22
11½	12½ x 12½	145–170	Favorable Average Unfavorable	26–32 20–25 16–20
11½	13½ x 13½	170–200	Favorable Average Unfavorable	22–28 16–22 12–16
12½	14¾ x 14¾	200–230	Favorable Average Unfavorable	18–23 13–18 11–13
13	15½ x 15½	230–260	Favorable Average Unfavorable	16–21 12–16 10–12
13½	16¾ x 16¾	260–300	Favorable Average Unfavorable	14–18 11–14 8.5–11
14½	18 x 18	300–340	Favorable Average Unfavorable	12–14 10–12 7.5–9.5
15½	19 x 19	340–390	Favorable Average Unfavorable	11–13 8.5–11 6.5–8
16½	20½ x 20½	390–440	Favorable Average Unfavorable	10–12 7.5–9.5 6–7.5
17	21¾ x 21¾	440–500	Favorable Average Unfavorable	7.5–9.5 6–7.5 5–6

HIGH INTENSITY MERCURY TRANSFORMERS AND REACTORS

High Intensity Mercury Lamps will operate only on alternating current circuits. They cannot be operated directly in any existing socket on a regular multiple circuit. On account of the difference between initial starting voltage required for the lamp and the final operating voltage, a transformer with high internal reactance or a reactor must be used with **each** lamp. The transformer or reactor acts like a valve to regulate the current of the lamp during starting period of lamp and to limit the current of lamp for slight changes in line voltage during normal operation.

The starting and operating voltage of the 400-watt mercury lamp are such that if service provides 220 to 240 volt range at the fixture then each 400-watt mercury lamp should be connected in series with a reactor. Service of 107 to 123-volt range, or 190 to 208-volt range for this lamp requires a step-up voltage transformer with high internal reactance instead of a reactor.

The starting and operating voltage of the 250-watt mercury lamp are considerably lower than for 400-watt lamp and because of low power factor a reactor is not recommended in series when service provides 220 to 240 volt range. Transformers with proper secondary voltage are, therefore, used for 220 to 240-volt range of service, 190 to 208-volt range of service, and 107 to 123-volt range of service.

Because the wattage input to the lamp must be closely limited, transformers and reactors are equipped with several line taps to meet all common service voltages. The nearest tap to available line voltage should always be used.

The use of a transformer with high internal reactance or a reactor to provide the necessary high starting voltage and somewhat lower operating voltage results in a reduced power factor unless corrected. This power factor will be approximately 65% on 400-watt transformers, 60% to 65% on 400-watt reactor depending on particular tap and approximately 50% on 250-watt transformers. Therefore, Transformer-Capacitor Units or Reactor-Capacitor Units are available to correct this condition. These units consist of two-piece cases with the transformer or the reactor mounted in the case below the capacitor of sufficient capacity to provide a power factor of 90% to 95%.

All units are available in two types of mounting—Suspension Mounting Type, from which lighting fixture can be hung, or Wall Mounting Type, which can be mounted on wall or ceiling or any flat surface.

The two-piece case, in each case, is of drawn steel finished with a blue-gray baked enamel.

On the Suspension Type Units, the upper half of the case has attached to it a ¾-inch Pipe Nipple through which two line leads, six inches long, project. A convenient form of conduit box should be attached to the ¾-inch nipple for suspending the unit and facilitate making line connections. If it is not convenient to suspend unit directly from conduit box a window with cover is provided in the upper half of case of Reactor-Capacitor, Transformer-Capacitor, and Transformer units to permit pulling leads into upper part of case for making line connections. On Reactor Units only, the lower part of case can be dropped to permit such connections.

The lower half of the case of Suspension Type Units is also provided with a ½-inch Pipe Nipple for suspension of the lighting fixture. The lower half of the case is also provided with a window with cover for access to the terminal board with the various line tap connectors and to permit lamp connections. Proper line tap connection is simply made by attaching lead with stud to proper spring snap terminal, eliminating soldered and taped joint. The change from one primary tap to another is accomplished in a few seconds time without the aid of tools. All line and lamp leads are equipped with solderless connectors to simplify installations.

The wall mounting type of unit is of the same general construction as the suspension type except that mounting lugs for side mounting are welded to side of case and suspension nipples are omitted. Also, all connections are made in the one end of case, necessitating only one window with cover for connections and access to the terminal board. Knockouts are provided in side and end of the connection compartment for ½-inch conduit permitting straight through wiring or entrance at lower end. Two knockouts are provided on the side 180° apart and two in the lower end.

The listings appearing below include "Transformer Only, In Case" and "Reactor Only, in Case." These units are similar to the high-power-factor units, except that power factor correction is omitted.

"Transformer Only—Bare" and "Reactor Only—Bare" are available for manufacturers to incorporate in their own housings. Only the transformer in "Transformer-Capacitor" unit has taps for the capacitor.

Description	Lamp Watts	Suspension Mtg. Style No.	Suspension Mtg. List Price	Suspension Mtg. Ship. Wt.	Wall Mtg. Style No.	Wall Mtg. List Price	Wall Mtg. Ship. Wt.	Bare Style No.	Bare List Price	Bare Ship. Wt.
Transformers for 107-115-123 Volt, 60 cycle Circuits										
Transformer—Capacitor Unit	400*	888 806	$15 00	30	888 802	$15 00	30	....	....	..
Transformer—Only in Case	400*	888 807	11 00	28	888 803	11 00	28	....	....	..
Transformer Only, Bare	400*	....	....	..	....	....	..	888 808	$8 50	22
Transformer—Capacitor Unit	250†	888 853	15 00	30	888 844	15 00	30	....	....	..
Transformer Only in Case	250†	888 841	11 00	28	888 840	11 00	28	....	....	..
Transformer Only, Bare	250†	....	....	..	....	....	..	888 838	8 50	22
Transformers for 190-199-208 Volt, 60 cycle Circuits										
Transformer—Capacitor Unit	400*	889 314	15 00	30	889 316	15 00	..	....	....	..
Transformer Only in Case	400*	889 315	11 00	28	889 317	11 00	..	....	....	..
Transformer Only, Bare	400*	....	....	..	....	....	..	889 318	8 50	22
Transformer—Capacitor Unit	250†	889 319	15 00	30	889 321	15 00	..	....	....	..
Transformer Only in Case	250†	889 320	11 00	28	889 322	11 00	..	....	....	..
Transformer Only, Bare	250†	....	....	..	....	....	..	889 323	8 50	22
Reactors for 220-230-240 Volt, 60 cycle Circuits										
Reactor—Capacitor Unit	400*	888 809	15 00	25	888 804	15 00	25	....	....	..
Reactor Only in Case	400*	888 810	9 75	20	888 805	8 75	20	....	....	..
Reactor Only, Bare	400*	....	....	..	....	....	..	889 312	6 75	12
Transformers for 220-230-240 Volt, 60 cycle Circuits										
Transformer—Capacitor Unit	250†	888 852	15 00	30	888 851	15 00	30	....	....	..
Transformer Only in Case	250†	888 848	11 00	28	888 847	11 00	28	....	....	..
Transformer Only, Bare	250†	....	....	..	....	....	..	889 313	8 50	22

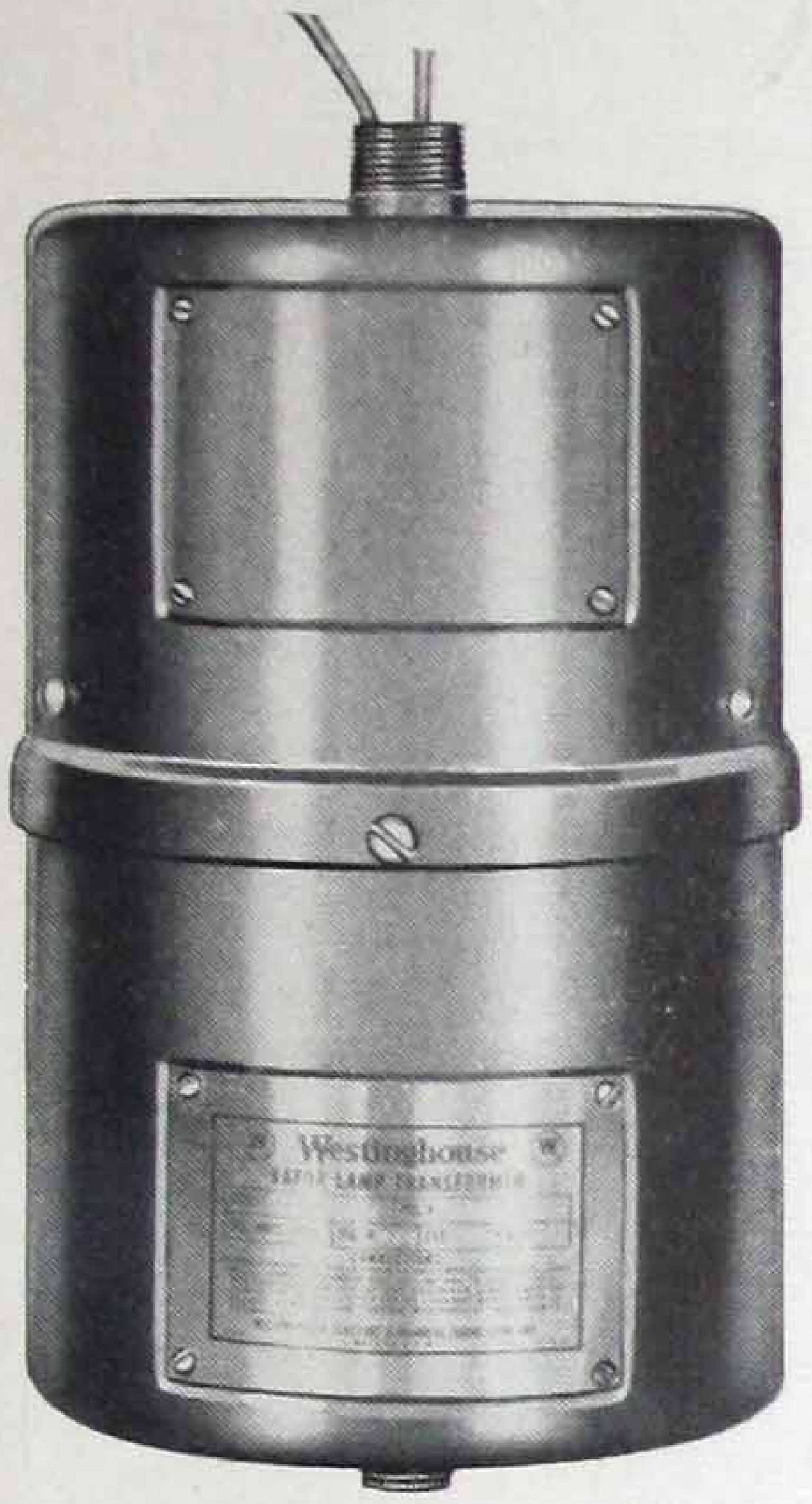
* For use with 400-watt Type H-1 Lamp.

† For use with 250-watt Type H-2 Lamp.

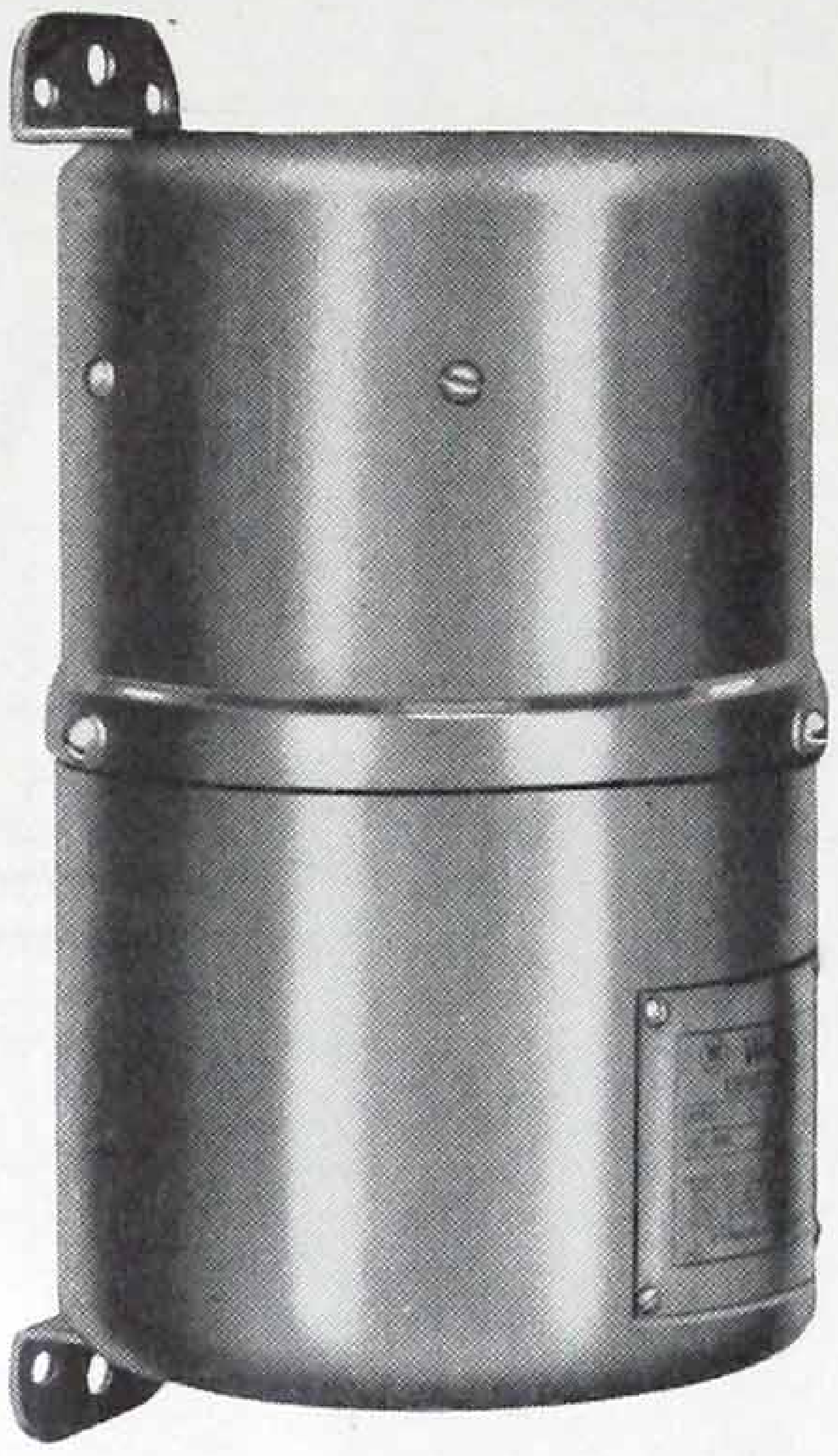
NOTE: 50 cycle Transformers and Reactors can be furnished on special order. Prices will be quoted upon request.

HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

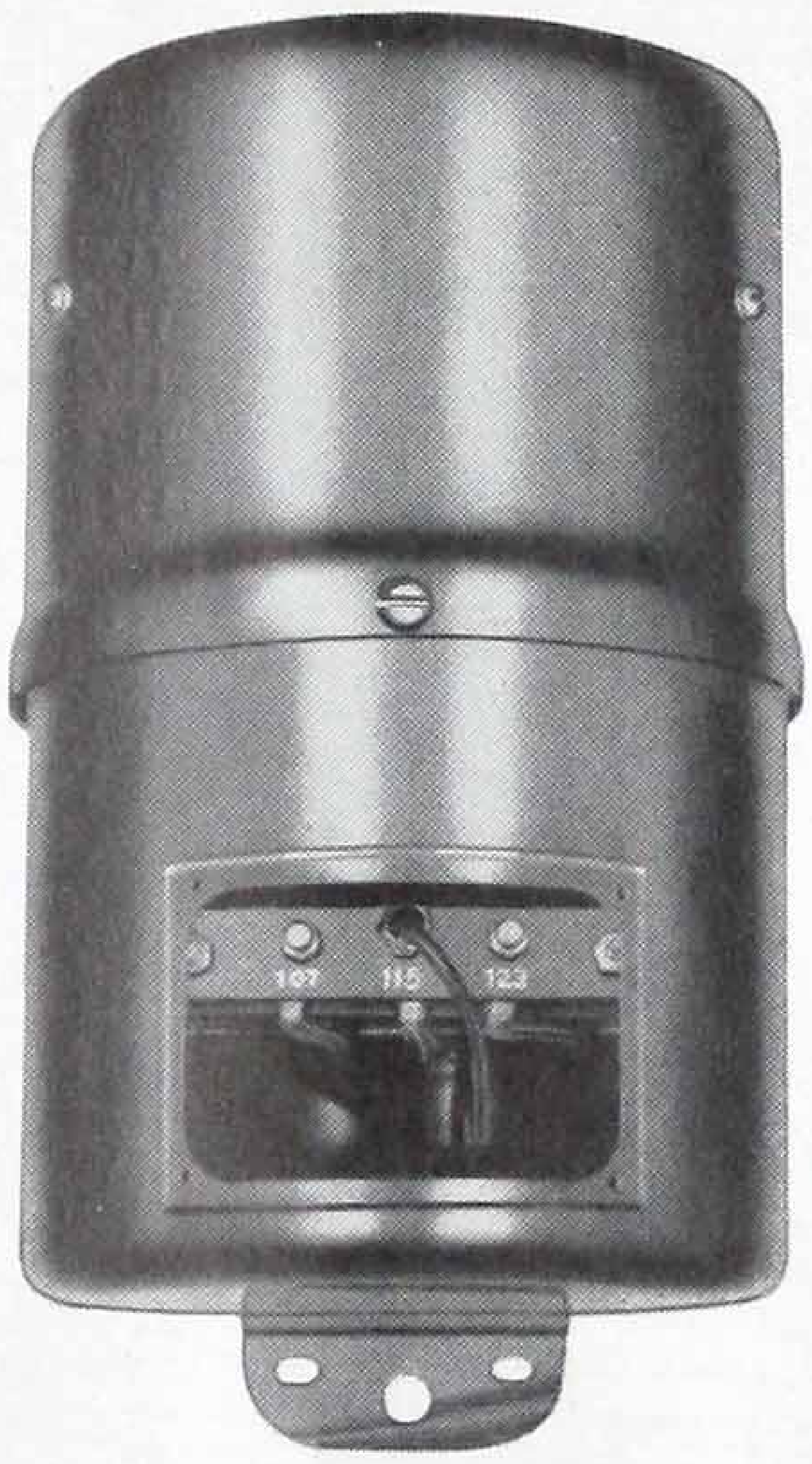
TRANSFORMERS AND REACTORS



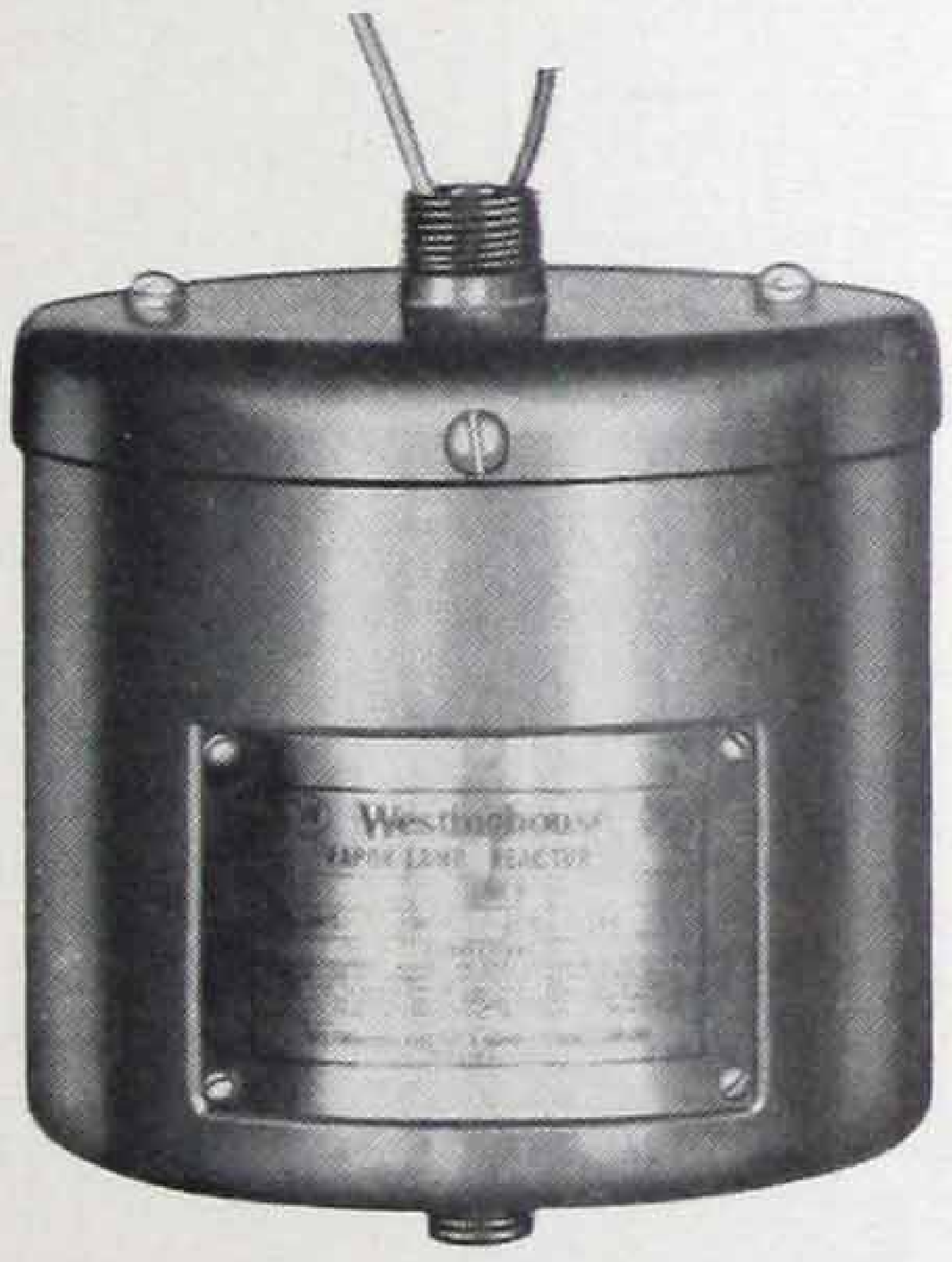
Reactor-Capacitor or Transformer-Capacitor or Transformer Only, Suspension Mounting



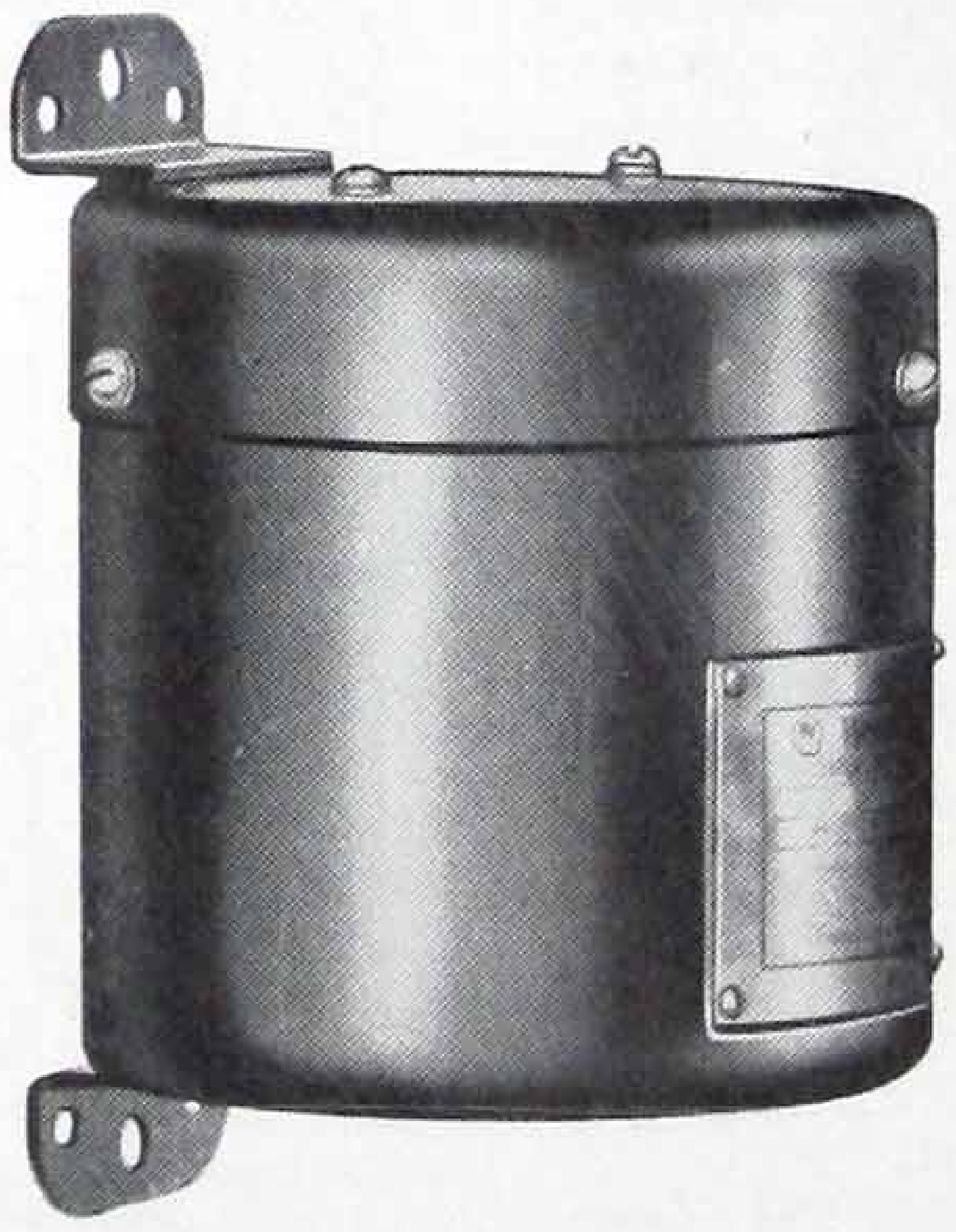
Reactor-Capacitor or Transformer-Capacitor or Transformer Only Wall Mounting



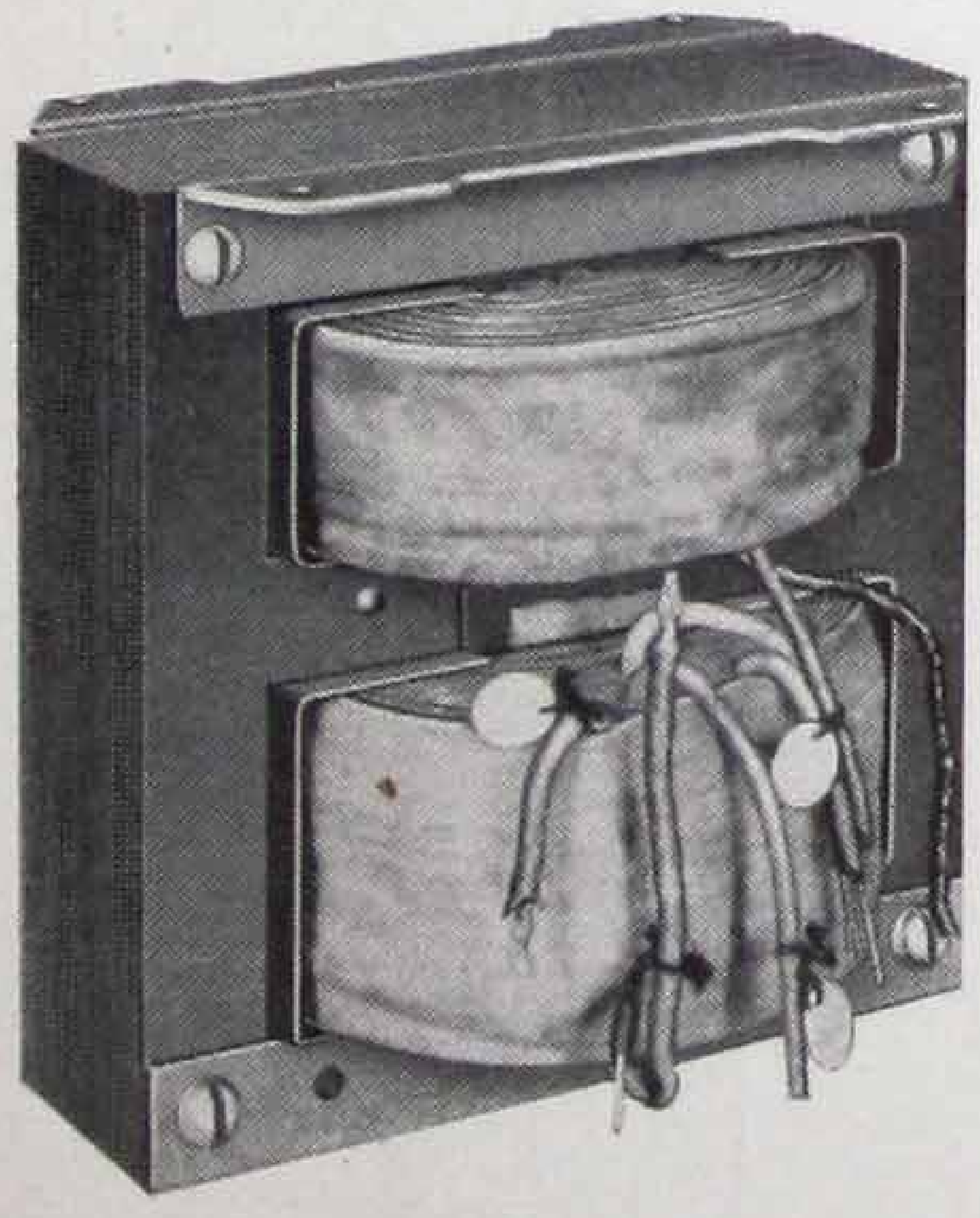
View of Terminal Board



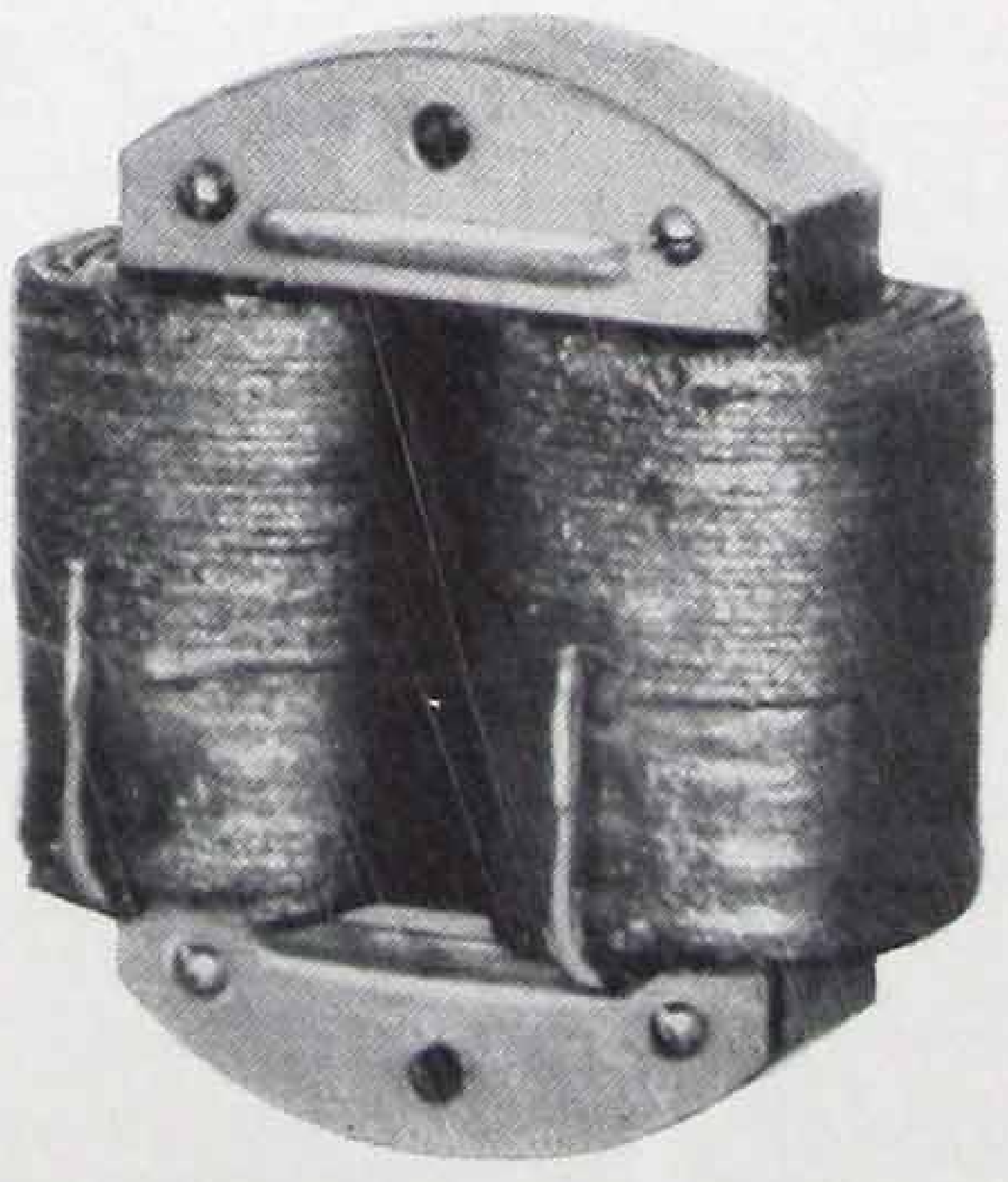
Reactor Only Suspension Mounting



Reactor Only, Wall Mounting



Transformer Only, Bare



Reactor Only, Bare

HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

TRANSFORMERS AND REACTORS

OUTLINE DRAWINGS

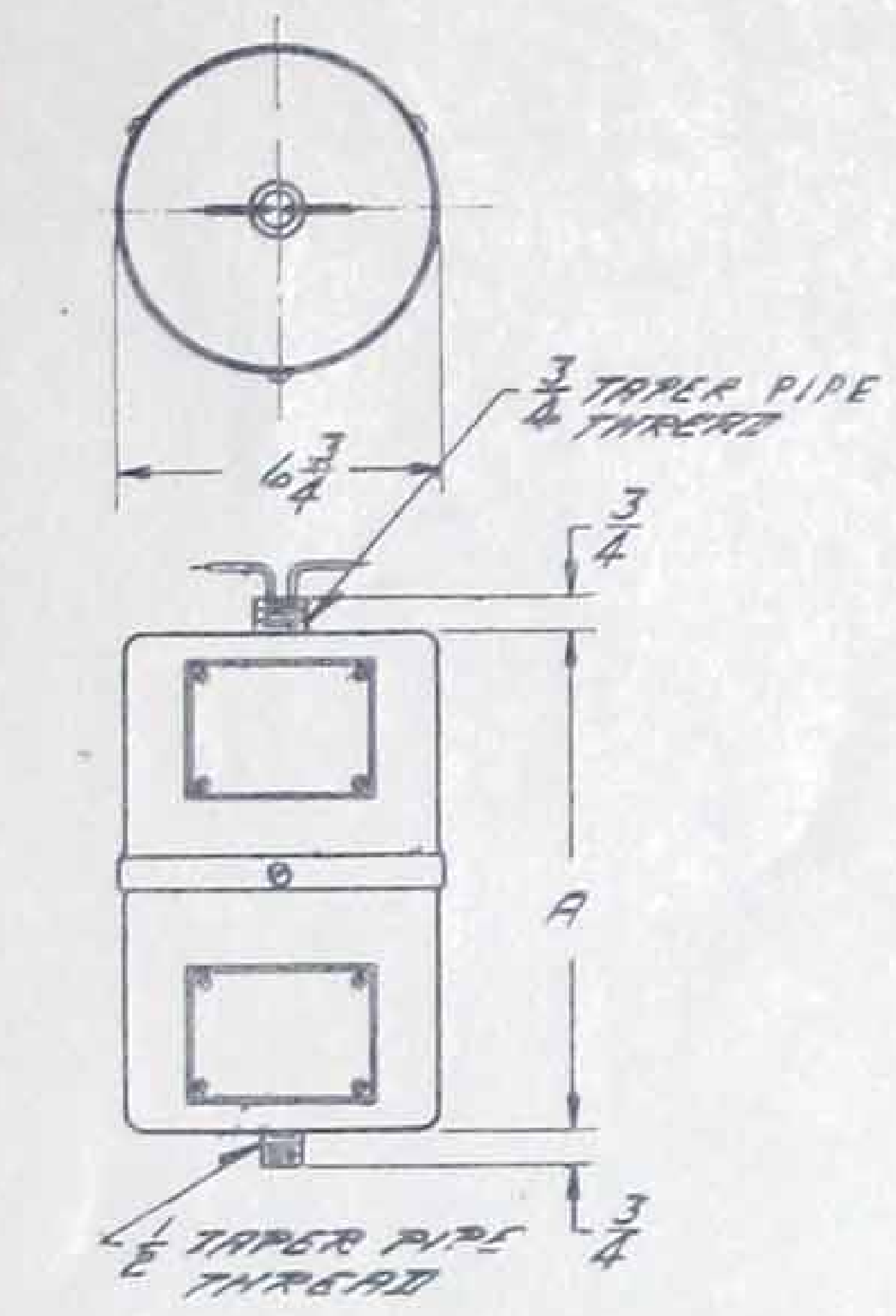


Fig. 1

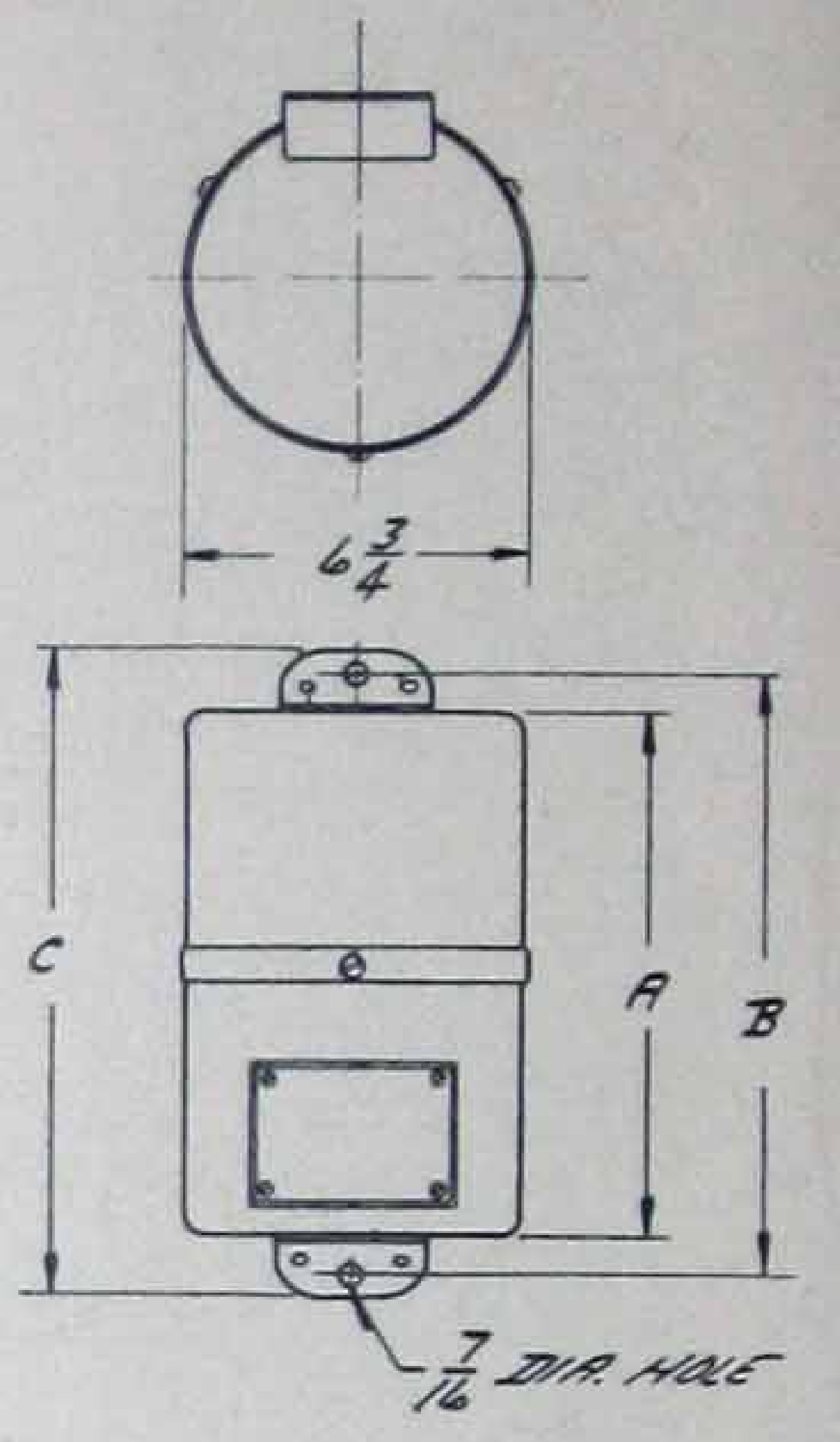


Fig. 2

Style	Figure	—Dimensions in Inches—		
		A	B	C
888 806	1	10⅜	....	....
888 853	1	10⅜	....	....
888 852	1	10⅜	....	....
888 809	1	10⅜	....	....
889 314	1	10⅜	....	....
889 319	1	10⅜	....	....
888 802	2	10⅜	11⅞	12⅞
888 844	2	10⅜	11⅞	12⅞
888 851	2	10⅜	11⅞	12⅞
888 804	2	10⅜	11⅞	12⅞
889 316	2	10⅜	11⅞	12⅞
889 321	2	10⅜	11⅞	12⅞
888 807	1	8 11/16	....	....
888 841	1	8 11/16	....	....
888 848	1	8 11/16	....	....
889 315	1	8 11/16	....	....
889 320	1	8 11/16	....	....
888 803	2	8 11/16	10 3/16	11 3/16
888 840	2	8 11/16	10 3/16	11 3/16
888 847	2	8 11/16	10 3/16	11 3/16
889 317	2	8 11/16	10 3/16	11 3/16
889 322	2	8 11/16	10 3/16	11 3/16
888 810	3	....	....	....
888 805	4	....	....	....
888 808	5	....	....	....
888 838	5	....	....	....
889 313	5	....	....	....
889 318	5	....	....	....
889 323	5	....	....	....
889 312	6	....	....	....

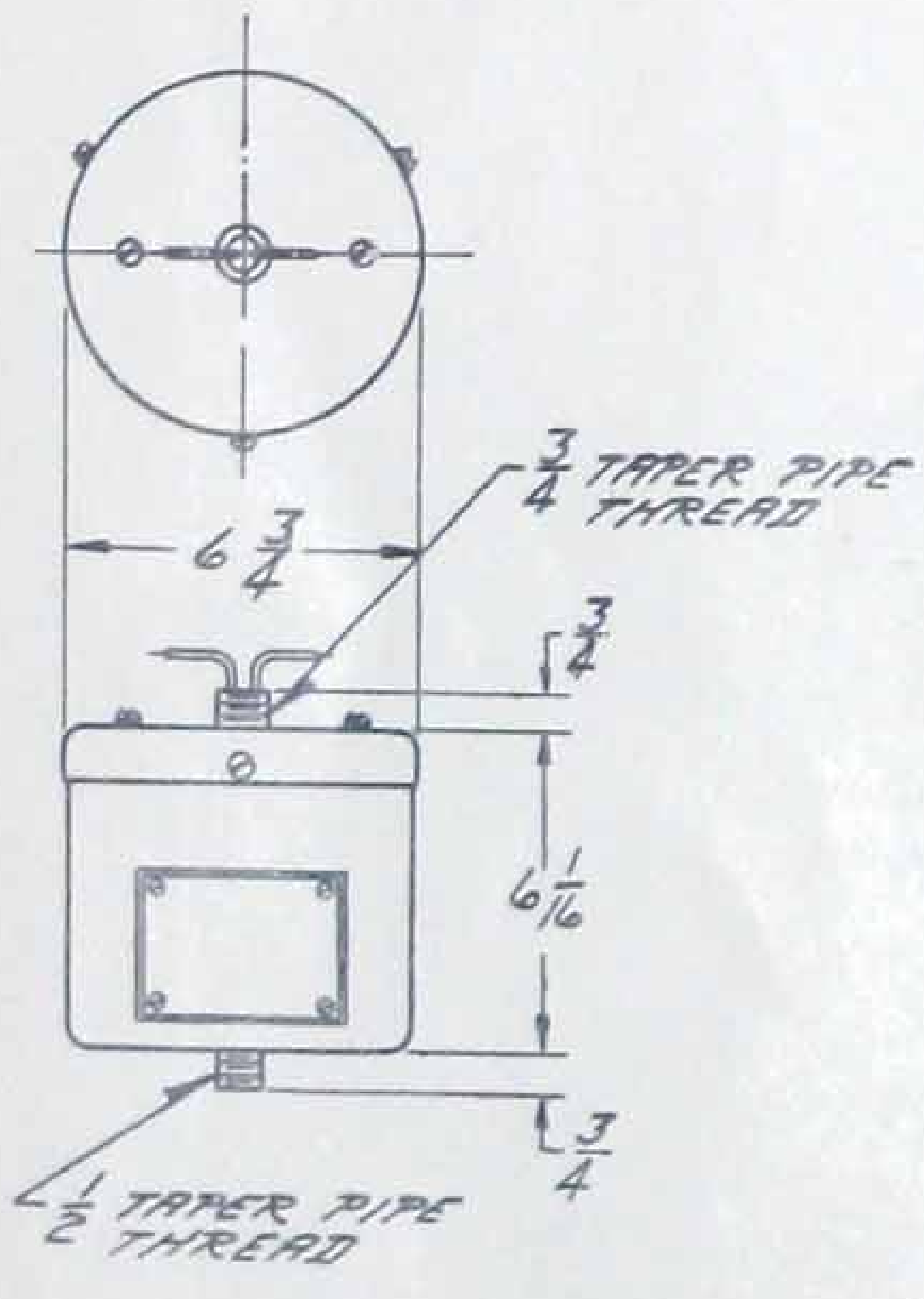


Fig. 3

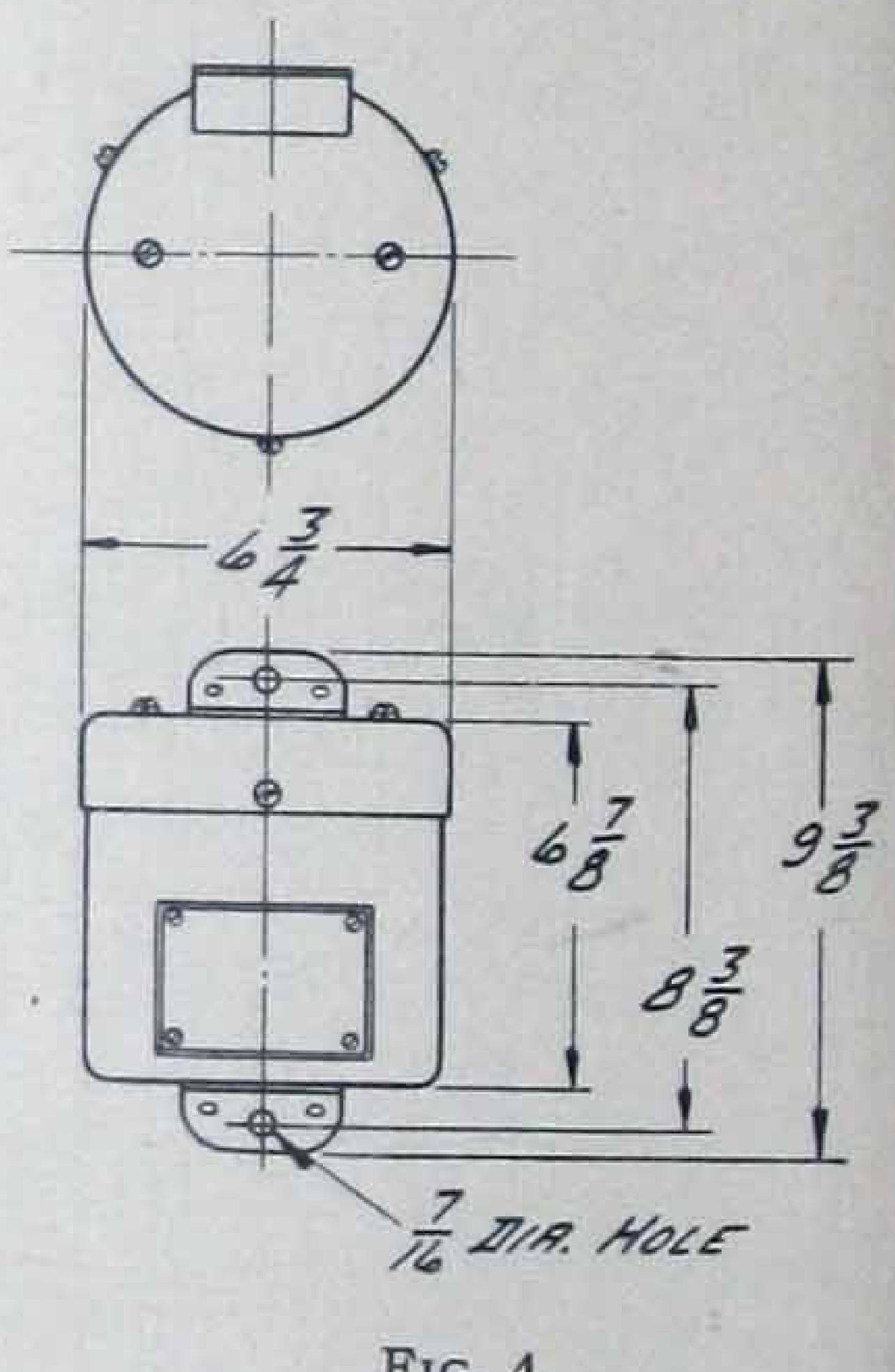


Fig. 4

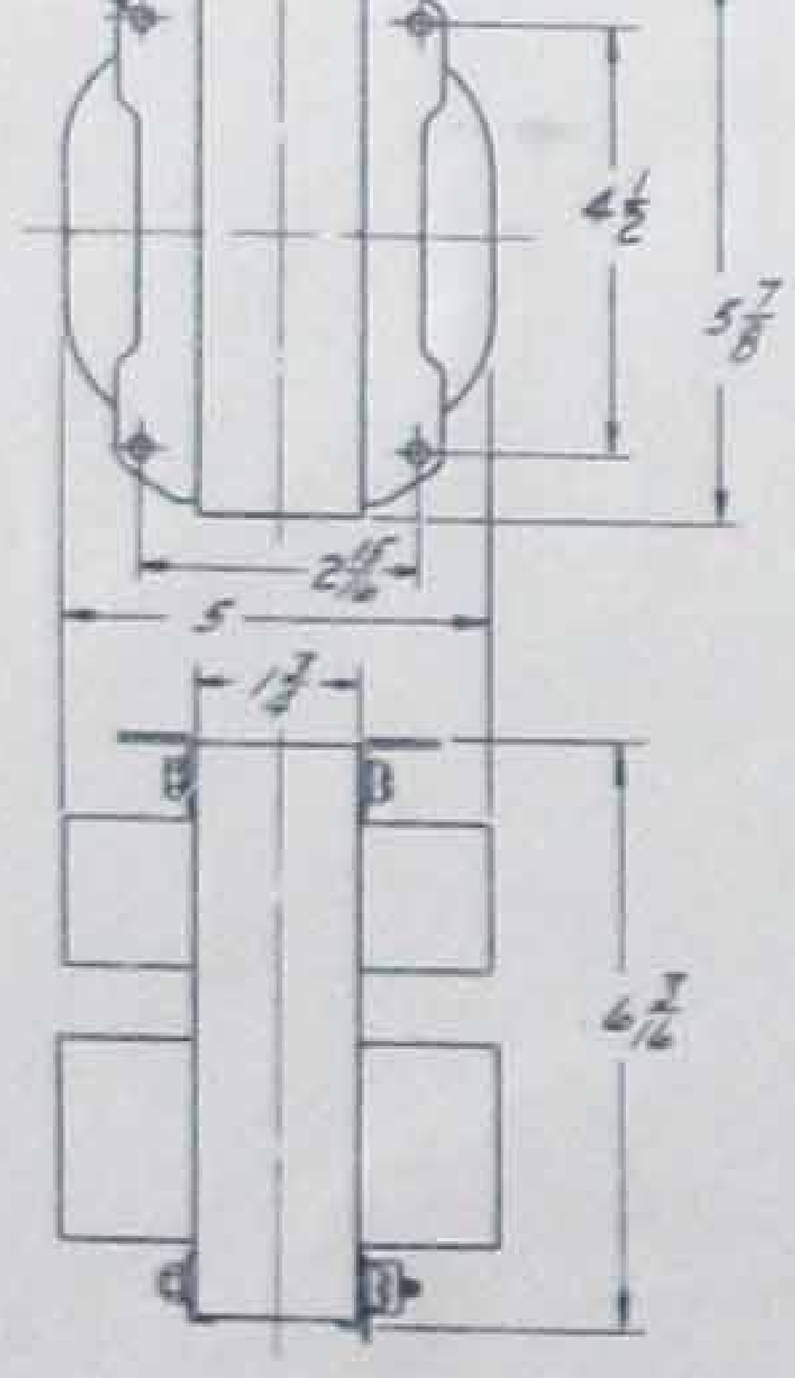


Fig. 5

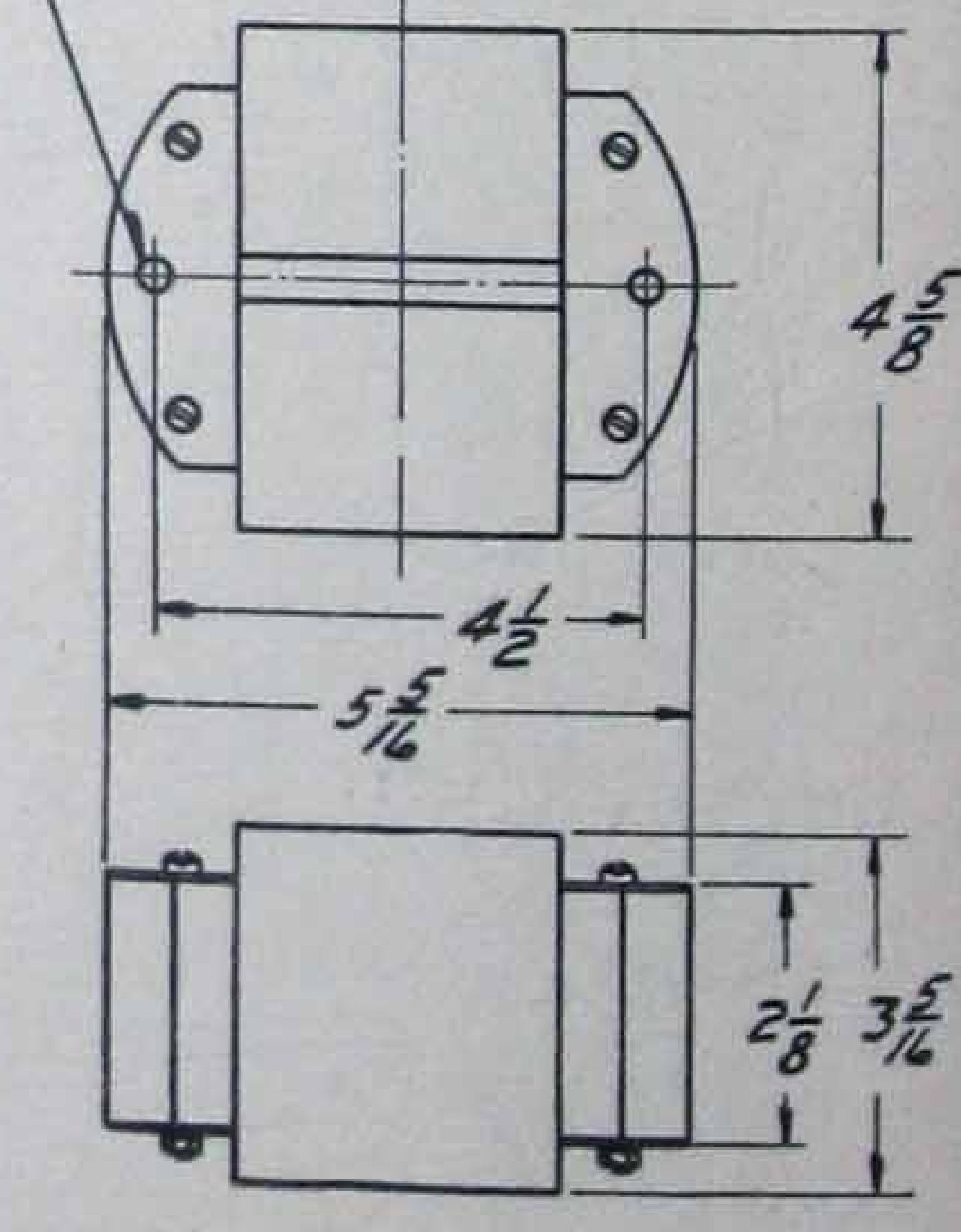
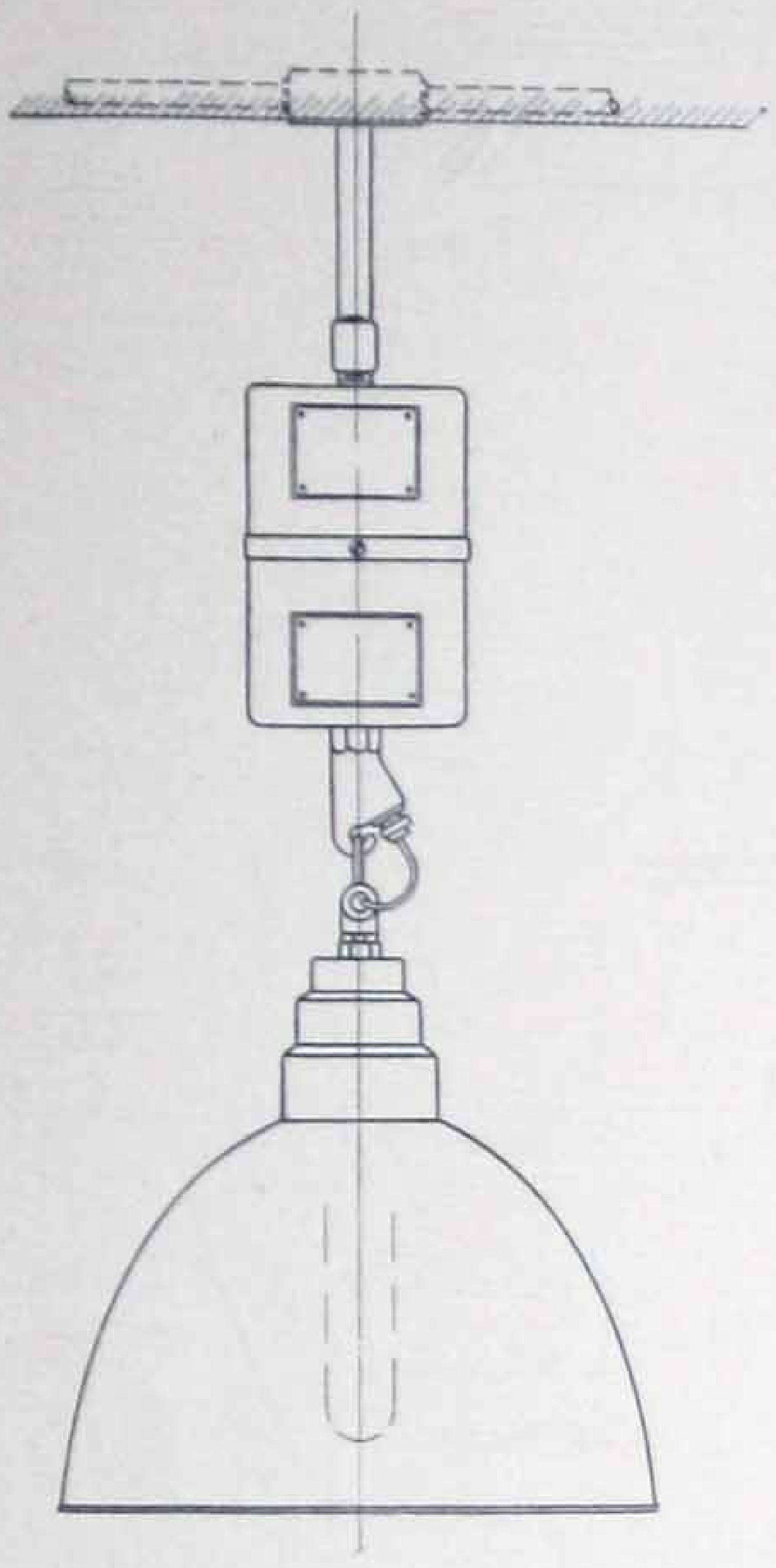


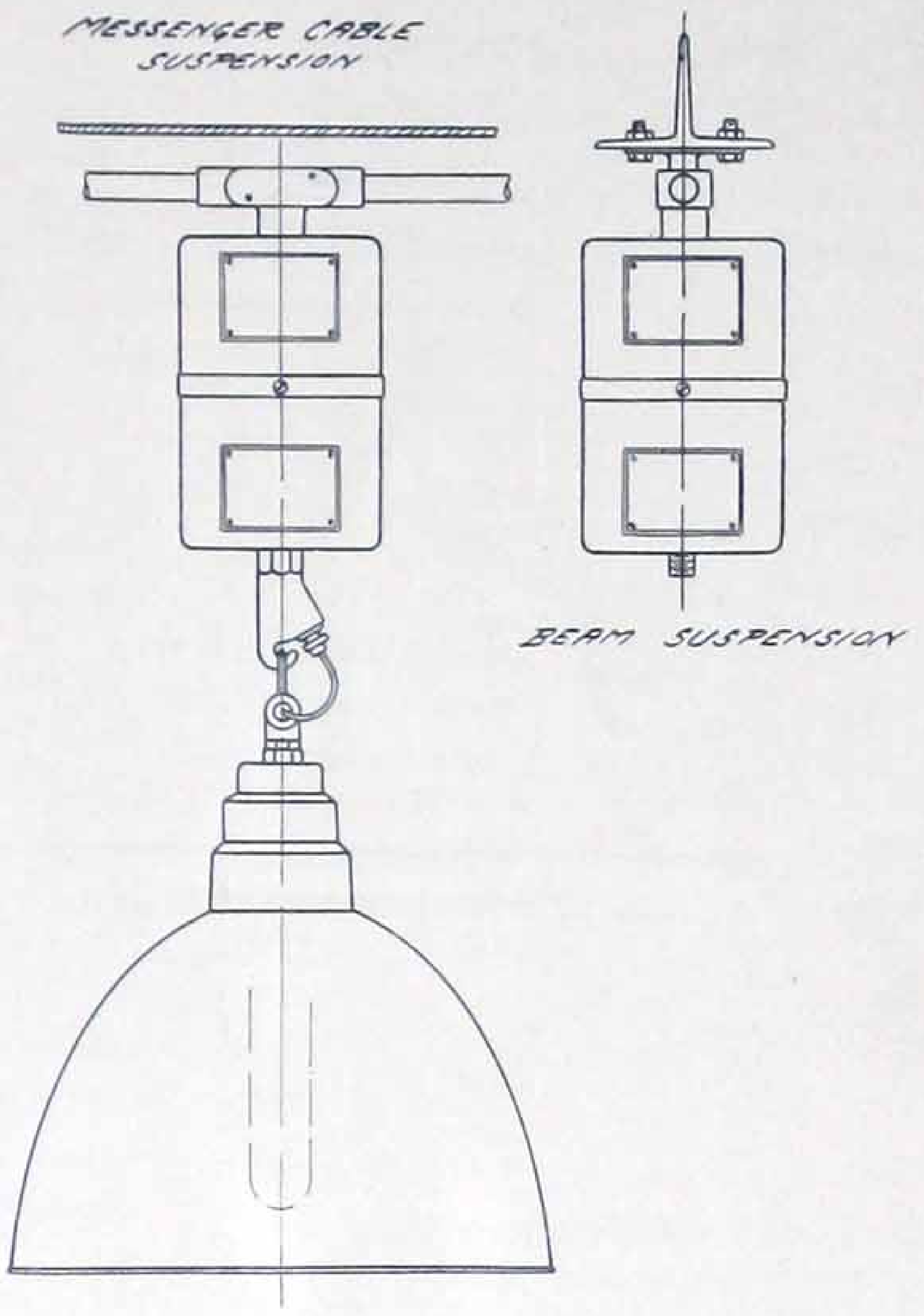
Fig. 6

HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

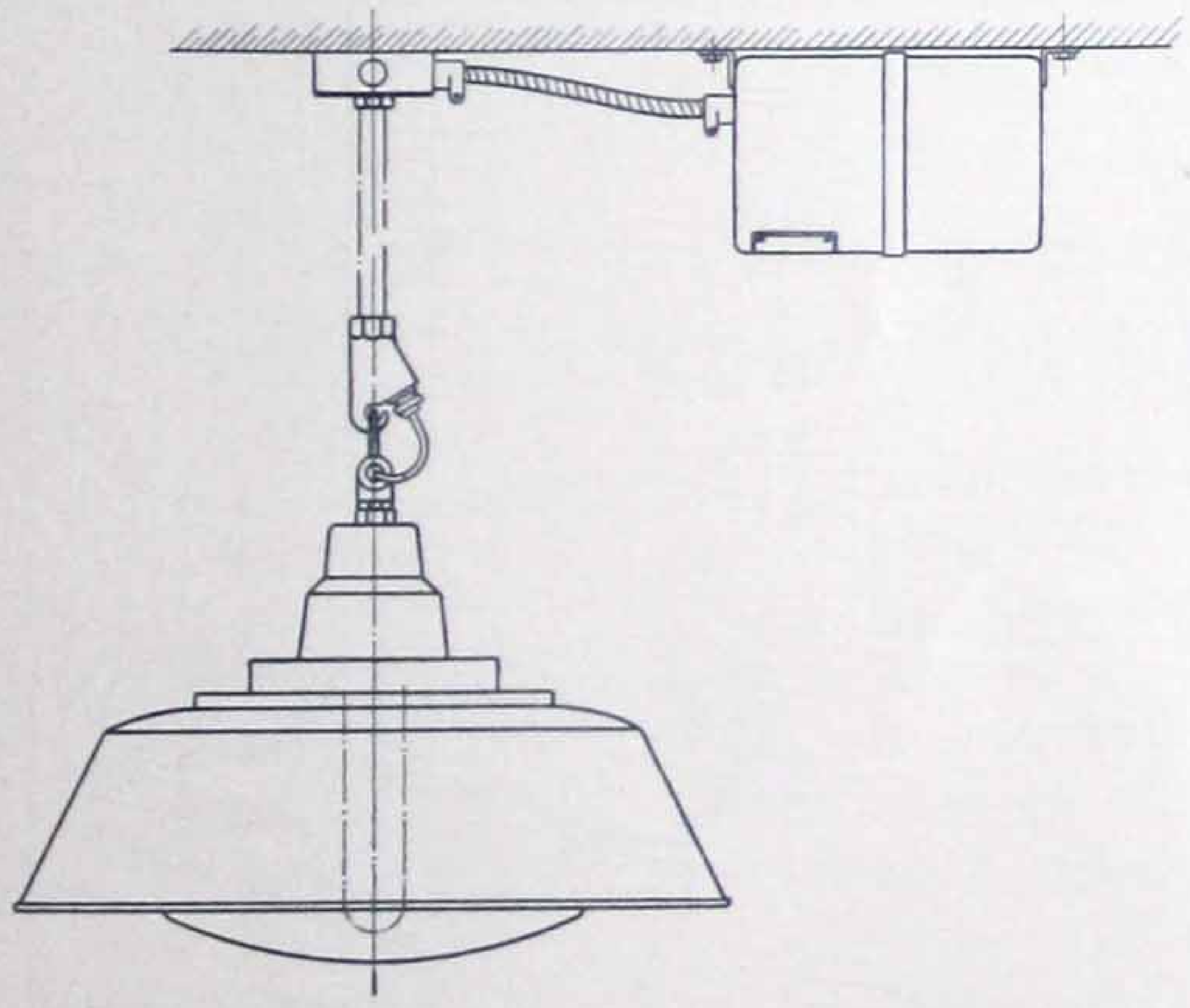
TYPICAL INSTALLATION ASSEMBLIES



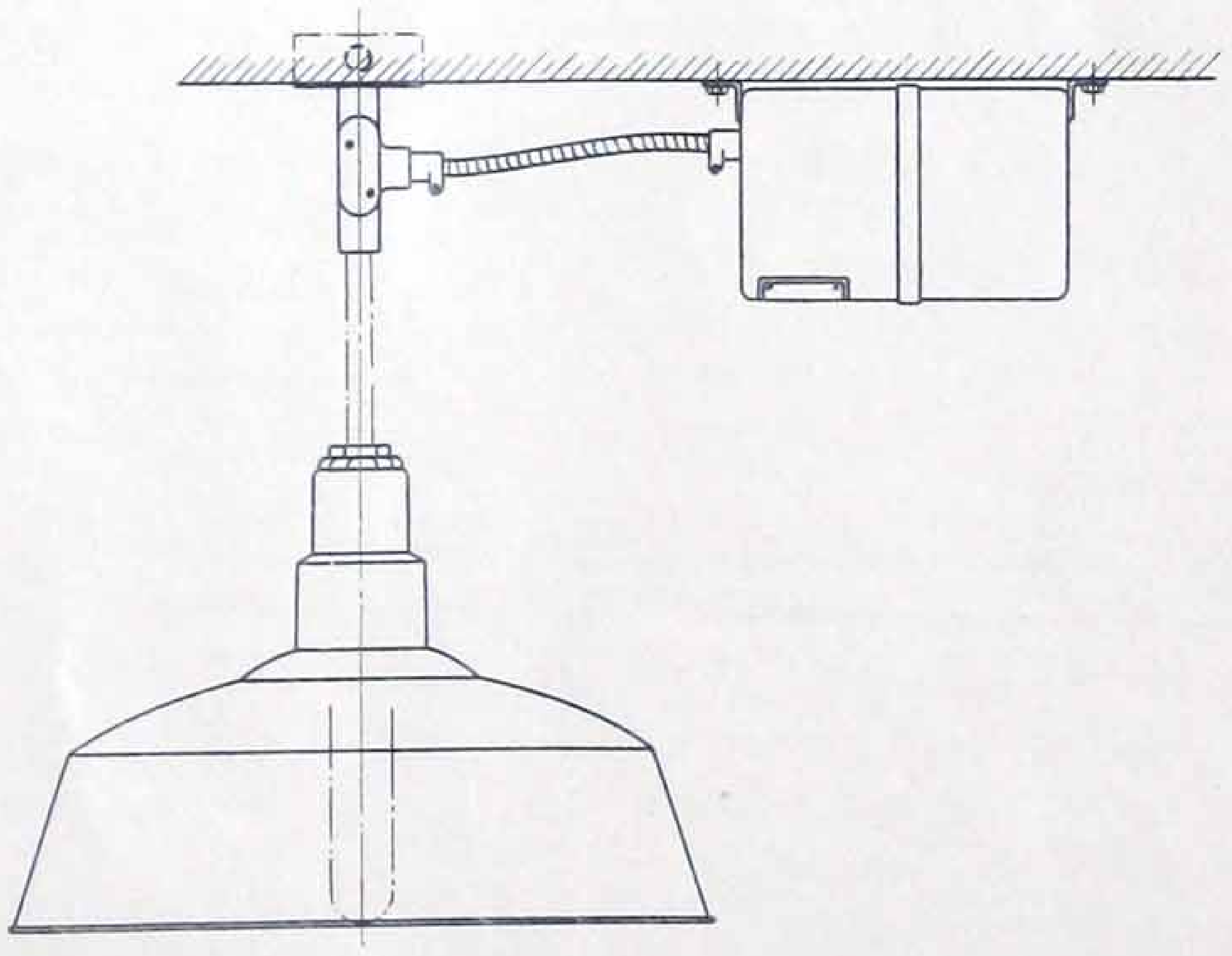
SUSPENSION MOUNTING TRANSFORMER, SAFECHANGE HANGER AND REFLECTOR WITH OUTLET BOX MOUNTED FLUSH WITH CEILING



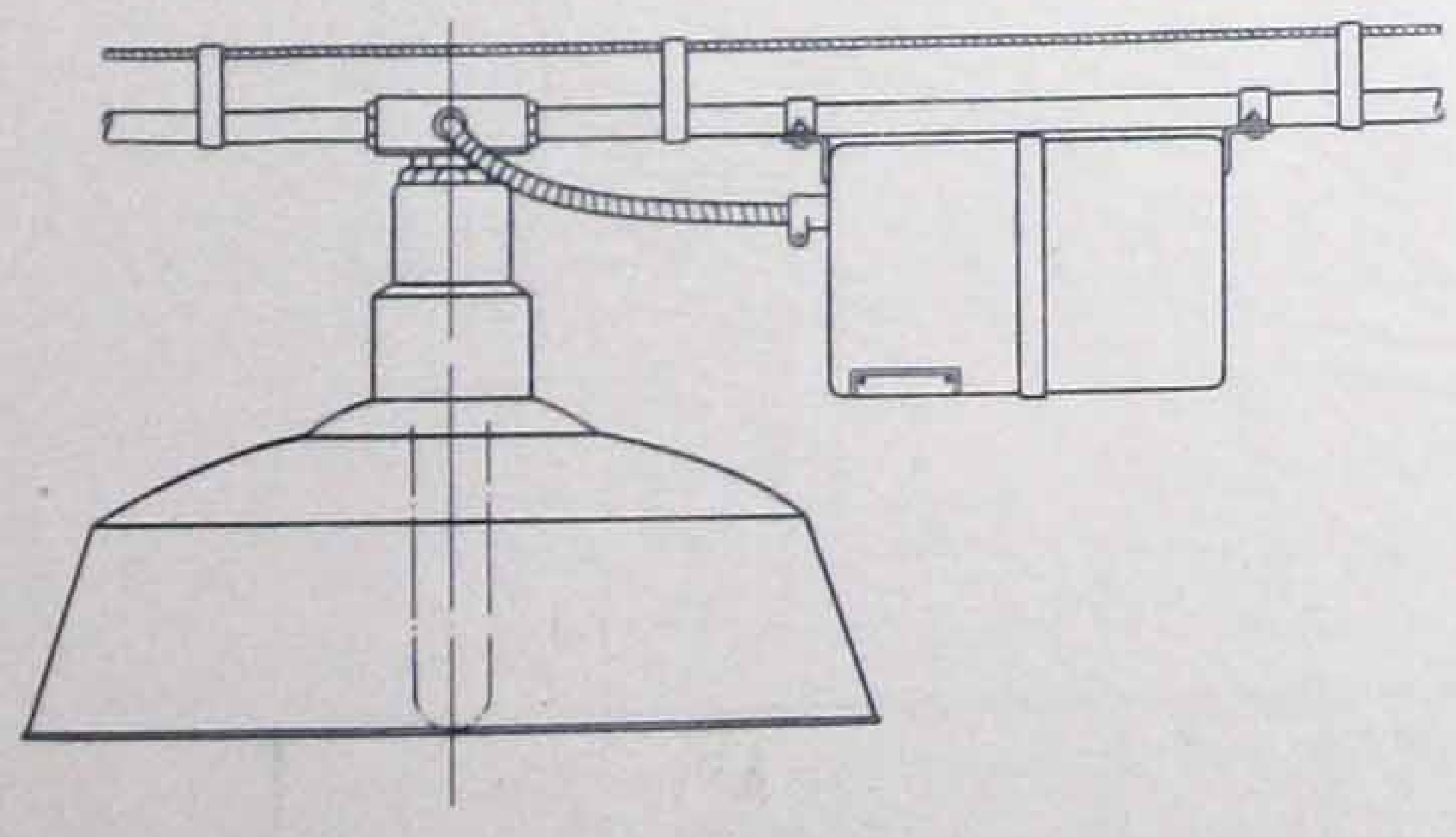
SUSPENSION MOUNTING TRANSFORMER, SAFECHANGE HANGER AND REFLECTOR WITH MESSENGER CABLE OR BEAM SUSPENSION



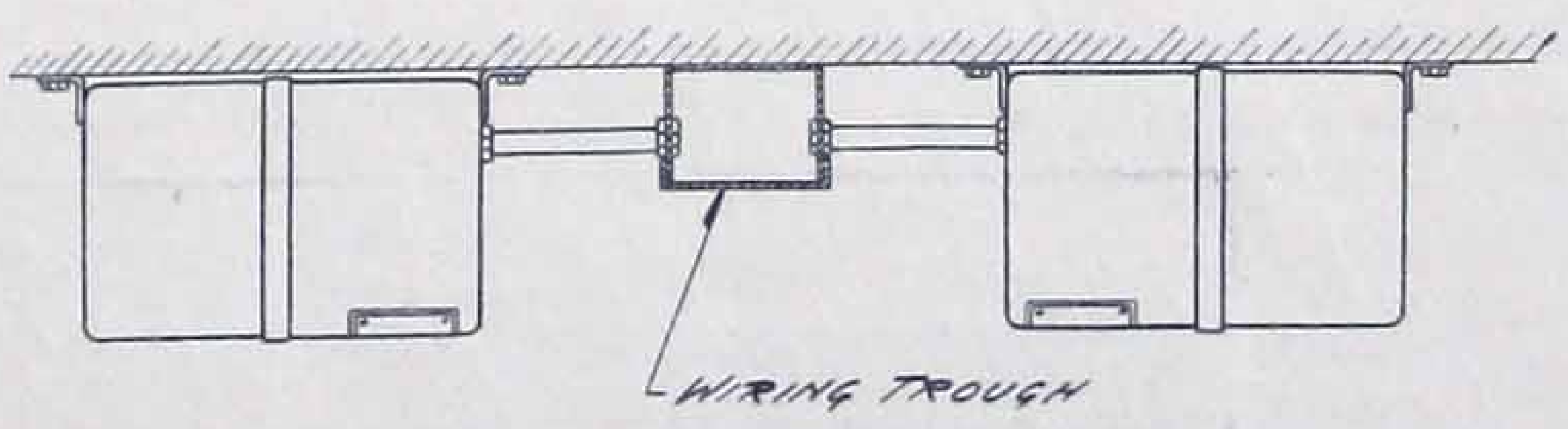
WALL MOUNTING TRANSFORMER, SAFECHANGE HANGER AND REFLECTOR WITH SURFACE MOUNTED OUTLET BOX



WALL MOUNTING TRANSFORMER AND REFLECTOR WITH OUTLET BOX MOUNTED FLUSH WITH CEILING



MESSENGER CABLE SUSPENSION OF CONDUIT, WALL MOUNTING TYPE TRANSFORMER AND REFLECTOR.
TRANSFORMER ATTACHED TO CONDUIT WITH CONDUIT STRAPS



GROUP OF WALL MOUNTING TRANSFORMERS

HIGH INTENSITY MERCURY LIGHTING EQUIPMENT

SAFECHANGE HANGER

The Safe-Change Hanger is used extensively to provide greater flexibility and ease of maintenance between High Intensity Mercury fixtures and accessories. The Hanger assures proper positioning of the lamp and reflector regardless of the position of the supporting stem. The Safe-Change Hanger also facilitates removing and replacing reflectors.

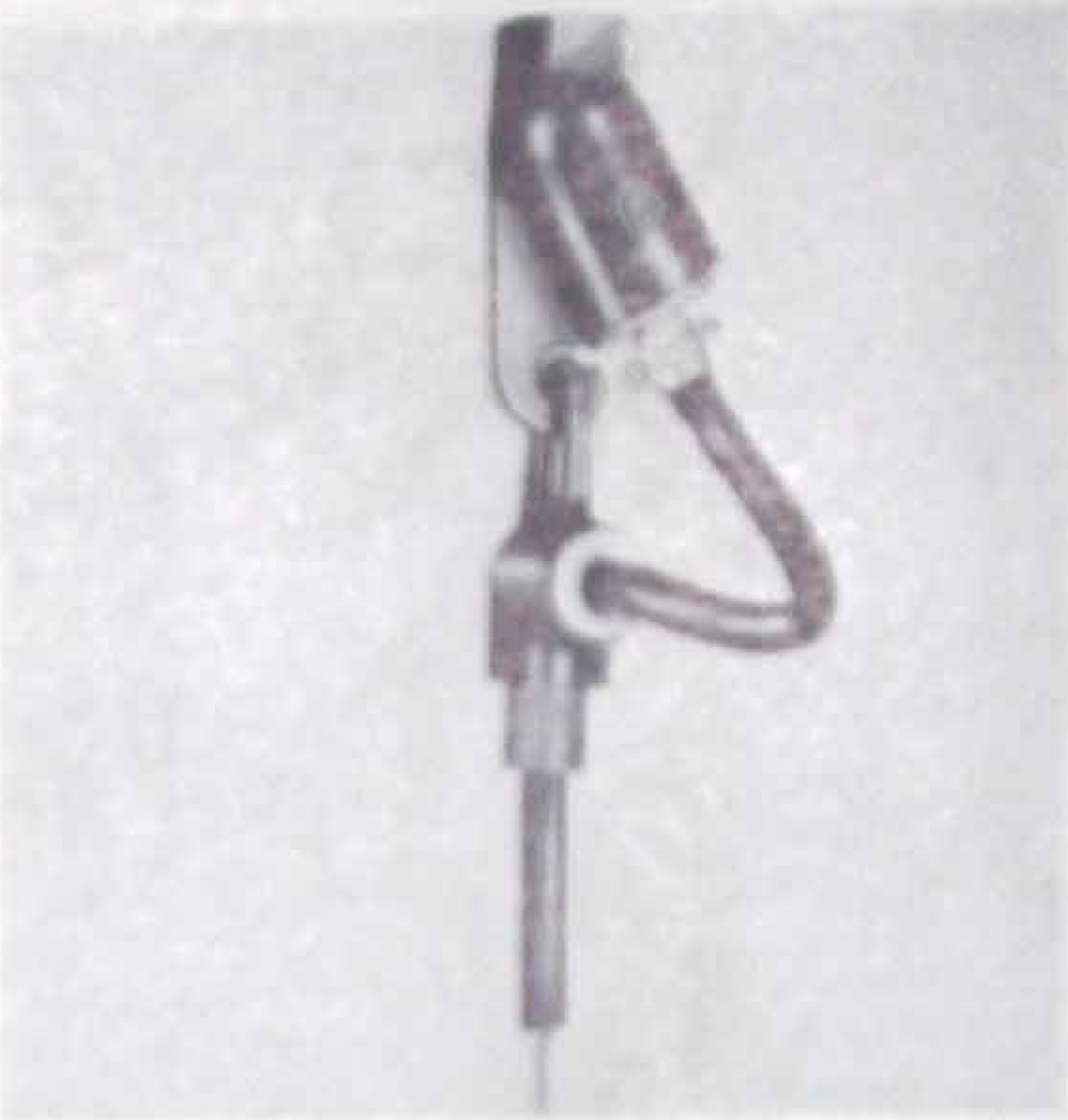
Simplicity—Consists of only two parts, an upper casting for attaching to the conduit and a lower casting for holding the socket.

Economical—Low investment and no maintenance.

Safety—The unit cannot be removed from its hook until the electrical connection is broken.

Polarized—Electrical connection cannot be reversed.

Flexibility—Large and small lighting units may be interchanged or replaced by simply removing the plug and unhooking the unit.



Safechange Hanger for ½-inch Conduit Sockets or Hoods

Time Saving—Lamps and reflectors can be cleaned quickly and easily.

All the maintenance man needs is a ladder and a few spare units. Taking a clean unit with him, the workman climbs the ladder, disconnects the plug of the hanging lamp and removes the unit with his free hand. With his other hand, he hangs the lighting unit that he carried up the ladder.

The attachment plug must be disconnected before the unit can be removed from the hook because, while the electrical connection is in place, the plug locks the unit on the hook. This arrangement eliminates the chance of a unit falling because of a knock or excessive vibration.

The Safe-Change Hanger consists of two small castings. The upper is threaded at the top for attachment to conduit and terminates in a hook with plug housing alongside.

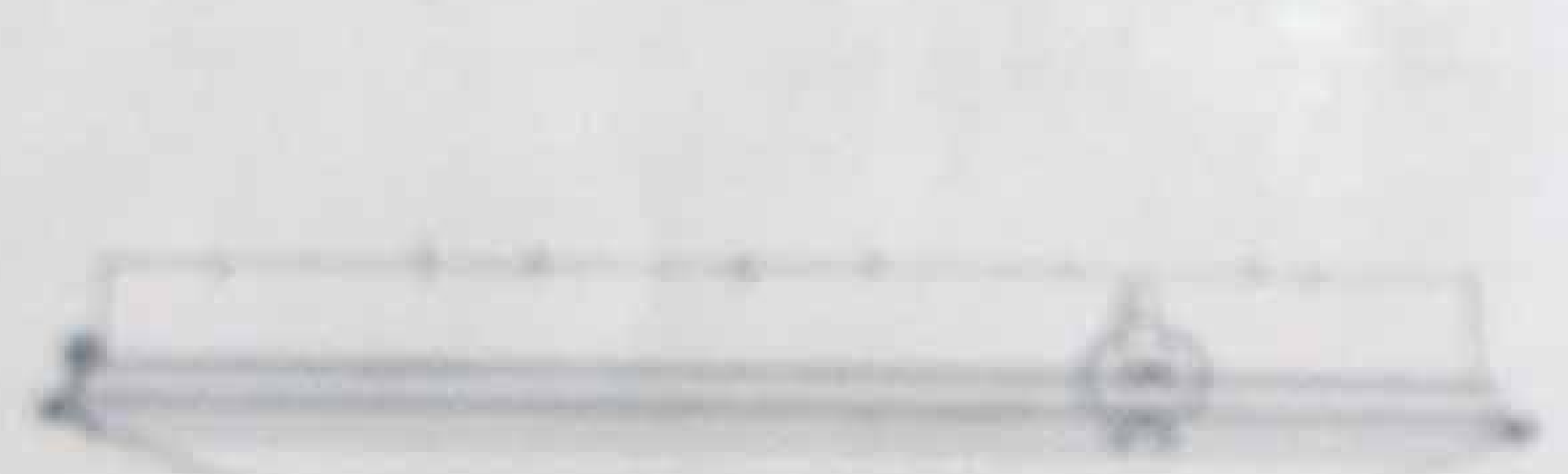
The lower casting consists of an eye to which the lamp socket is attached. Current is conducted to the lamp through the receptacle and plug from which it enters the socket through an insulated bushing.

For All Sockets or Hoods Tapped for ½-Inch Conduit

Type of Mounting	Standard Pkg. Quantity	Standard Pkg. Wt. Lb.	Style No.	List Price
½-inch Conduit	10	15	346 571	$2 75
4-inch Outlet Box	10	15	346 572	2 75

DUST-TIGHT GLASS COVERS FOR REFLECTORS

Hinged Glass Cover

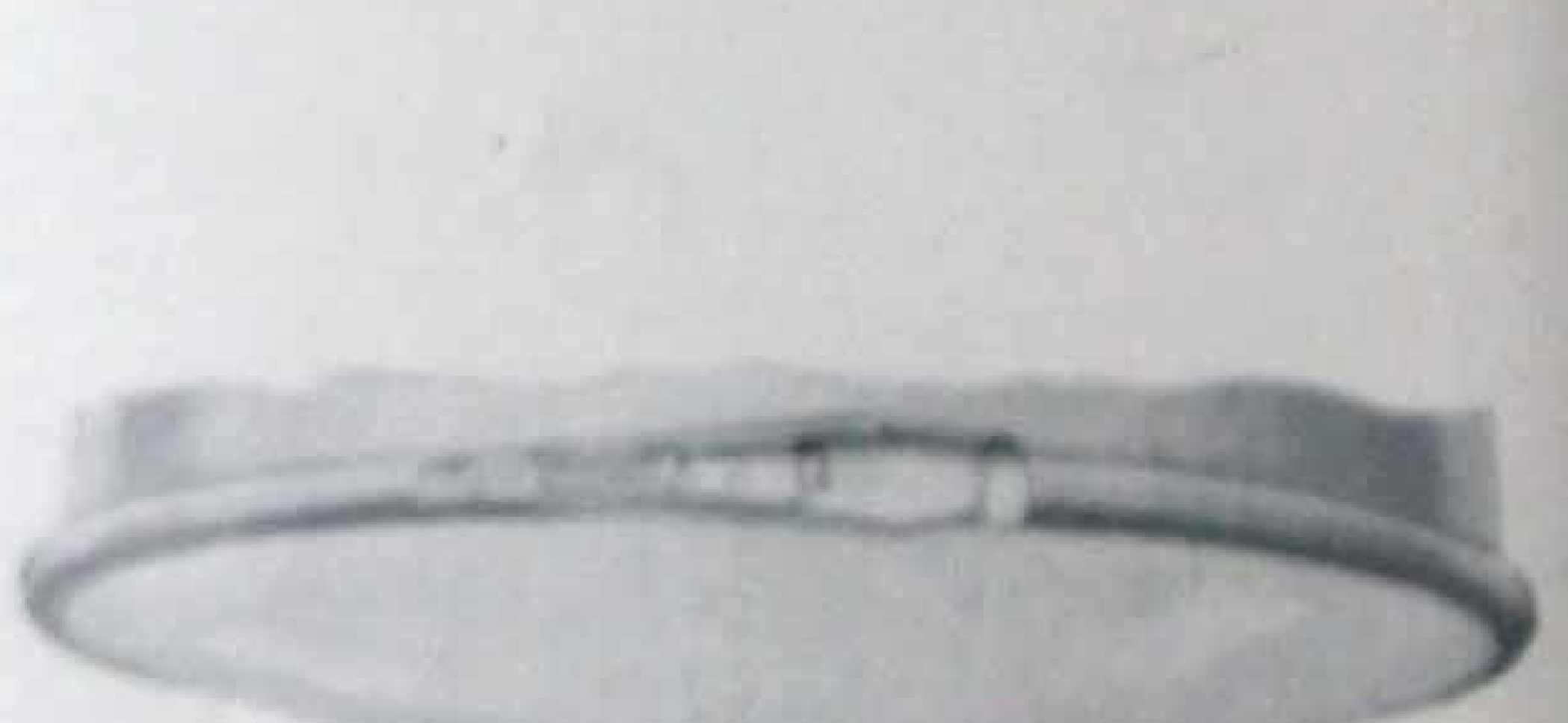


Detail of Hinged Glass Cover

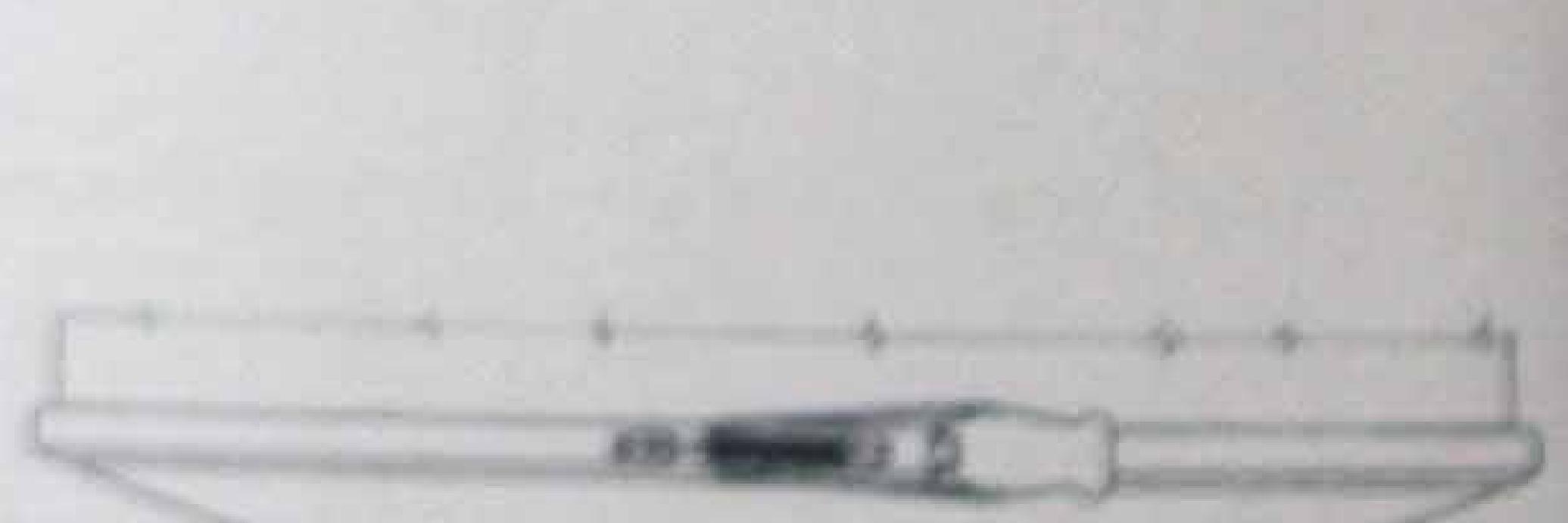
Considerable time can be saved in the cleaning of the reflector when glass covers are used since much less time is required to clean the smooth outer surface of the glass cover than the lamp and the inside of the reflector.

The complete hinged cover is held to the reflector by a wire ring. The cover is hinged to this ring and the felt gasket is held tightly against the edge of the reflector by clips. By releasing these clips the lamp can be replaced without difficulty.

Snap covers are also available. These attach directly to the reflector bead by an expanding "U" shaped band which securely locks the glass lens to the reflector. This cover is so designed that when it is expanded for removing lens it can be locked in this position.



Snap Glass Cover

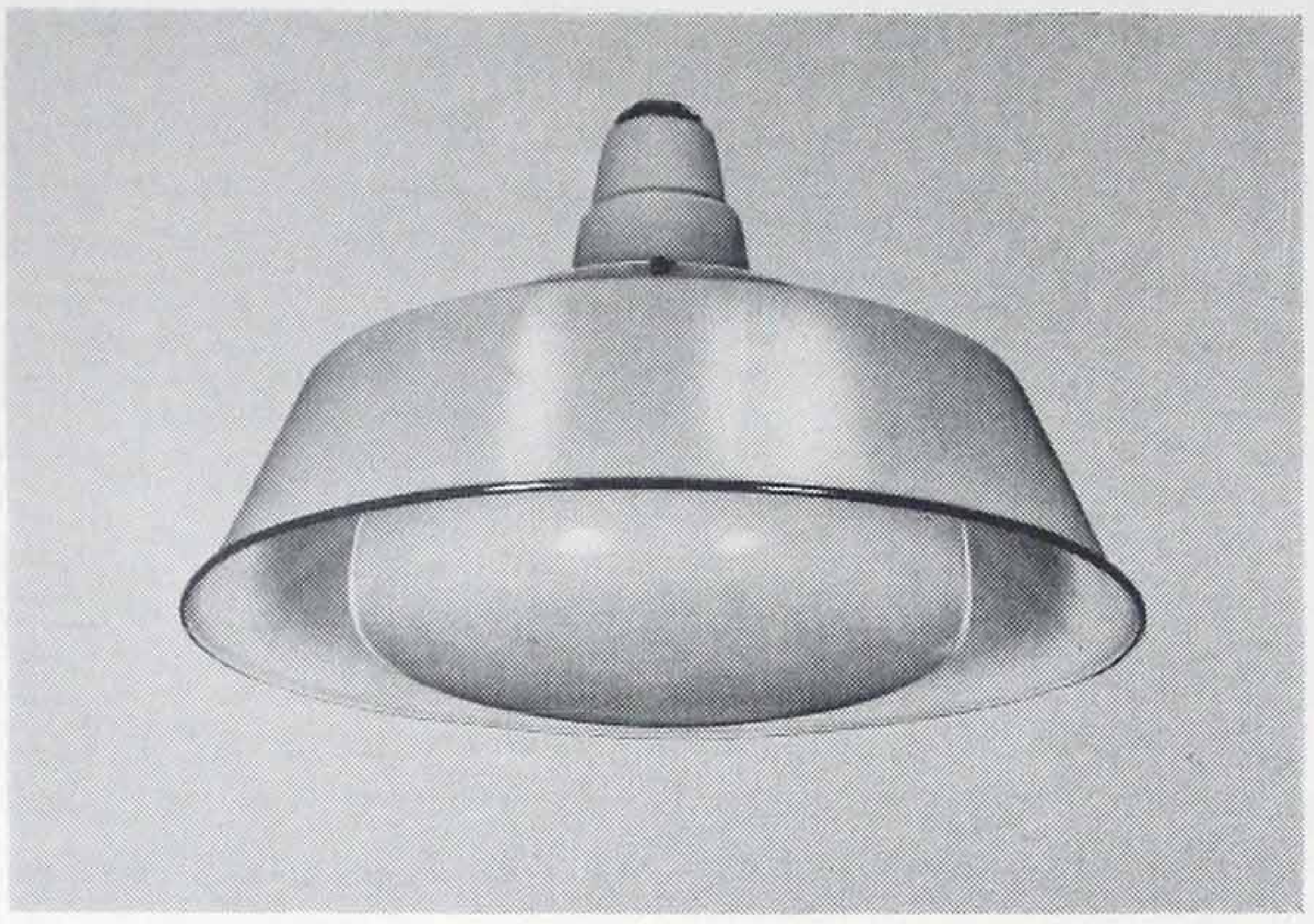


Detail of Snap Glass Cover

The Alzak finish process applied to industrial reflectors, described in this Catalog, is a patented one and the term Alzak has been registered by the Aluminum Company of America as a trade-mark applicable to reflectors.

REFLECTORS AND ACCESSORIES FOR 400-WATT HIGH INTENSITY MERCURY LAMPS

Aluminum Low, Medium and High Mounting Reflectors



Glassteel Diffuser Reflector and Globe

The Westinghouse High, Medium and Low mounting aluminum reflectors are designed to properly distribute the light from the 400-watt High Intensity Mercury lamp where the mounting height is 18 feet or over.

For mounting heights lower than 18 feet, the Westinghouse one-piece Glassteel Diffuser with the 400-watt High Intensity Mercury lamp should be used.

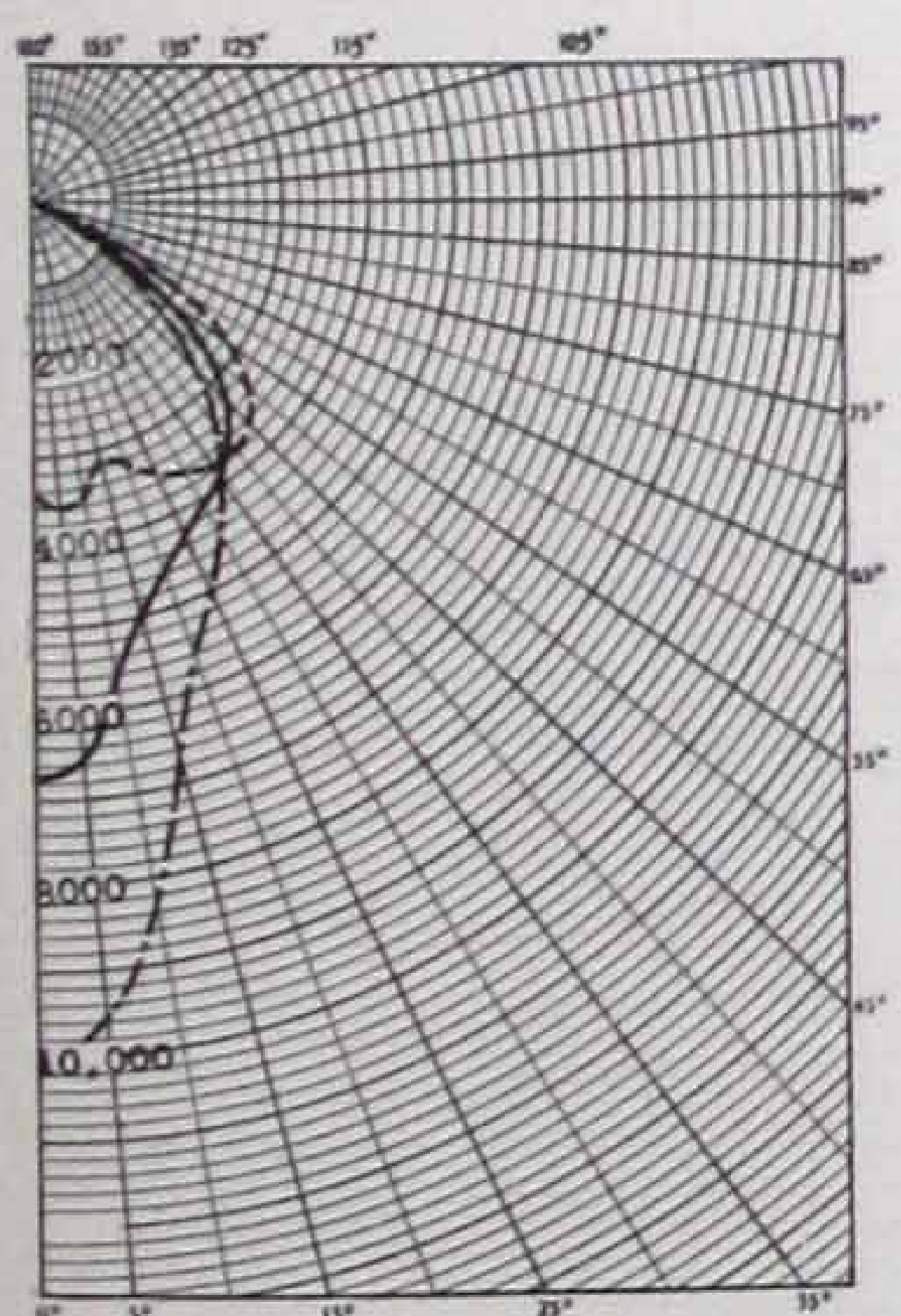
The High mounting reflectors are made from commercially pure "etching grade" aluminum sheet. Their shape is such as to make them especially strong and durable after fabrication. The Mogul type skeleton socket with high heat wax and nickel plated interior is held in place by a cast brass adapter which is locked to the reflector by means of a special cast aluminum cap.

Reflectors are supplied for ½-inch conduit mounting. The cast aluminum cap has a left hand thread which permits tightening of both cap and reflector on conduit. This provides a positive location of the mercury lamps in proper position in the reflectors. The outside surface of the reflector is protected by one coat of glossy green baked enamel. The reflecting surface is prepared by acid etching.

Westinghouse 24" High Intensity Glassteel Diffusers are drawn from Armco Iron and are finished with one ground coat and two white coats of porcelain enamel inside and outside. This reflector uses the same socket and holding construction as the aluminum reflectors referred to above. The globe used is of Monax single layer homogeneous glass and is equipped with a copper globe protecting ring.

Since the 400-watt High Intensity Mercury Lamp will not operate on ordinary lighting circuits, it is necessary to provide suitable current limiting accessories. These will be found described and listed on the reverse side of this sheet.

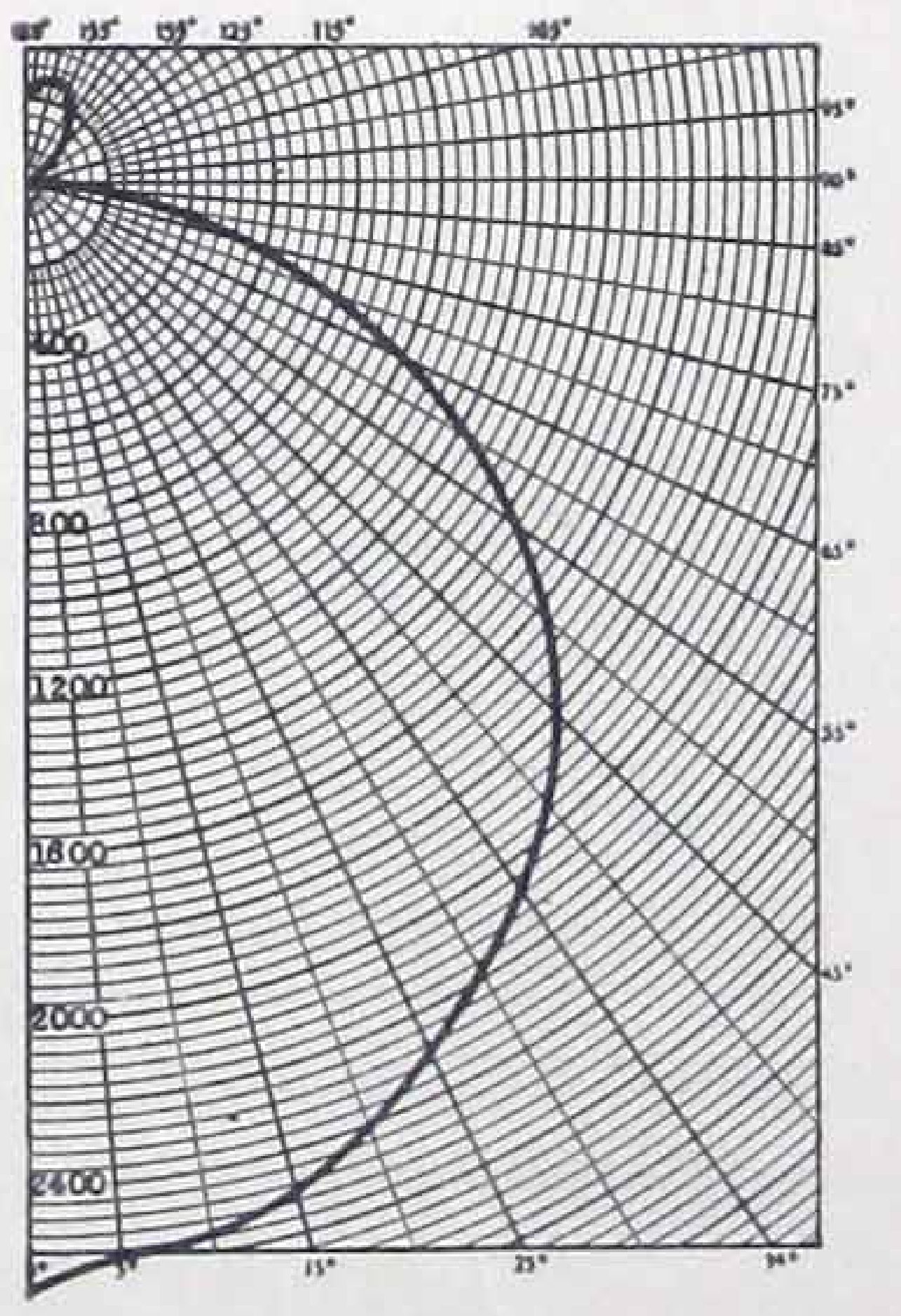
To provide greater flexibility and ease of maintenance, between the fixture and the accessories, the Westinghouse Safechange Hanger is recommended. This device consists of a hook and loop assembly held together in such a manner that the mechanical connection cannot be broken until it is first disconnected electrically. Thus a safe, simple and positive connection is made. (See Page 2 of Industrial Catalog Section 61-173).



Vertical Distribution with Aluminum Reflectors at 25, 35 and 50 Feet Mounting Heights

Mounting Height in Feet	Mercury Lamp Size in Watts	Diam. Inches	Depth Inches	—Standard Pkg.— Qty.	Wt.	Style No.* for ½-inch Conduit
ALUMINUM REFLECTORS COMPLETE WITH SOCKET						
18 to 25	400	18	17⅛	4	30	789 585
25 to 35	400	18	18⅛	4	30	789 586
35 to 50	400	18	18⅝	4	30	789 587
GLASSTEEL DIFFUSER COMPLETE WITH SOCKET AND GLOBE						
18 ft. or under	400	24	16	2	65	785 477
GLASSTEEL DIFFUSER REFLECTOR AND SOCKET ONLY						
	400	24	14	2	50	789 584 ✓
GLASSTEEL DIFFUSER GLOBE ONLY						
	400	16	10	2	15	340 927
SAFECHANGE HANGER FOR ½-INCH CONDUIT						
				10	15	346 571

*Style numbers do not include lamps—refer to Westinghouse Lamp Company or its agents.

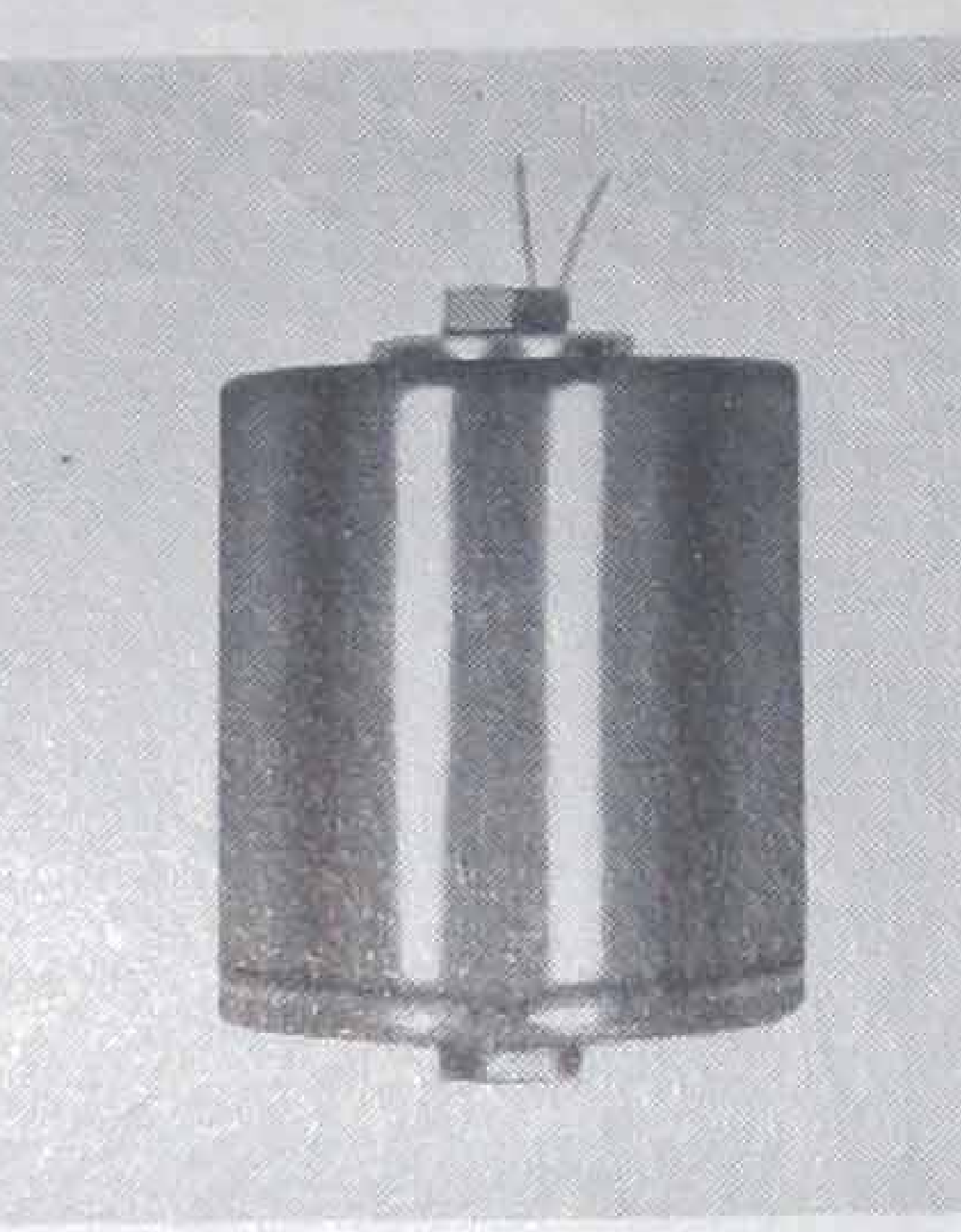


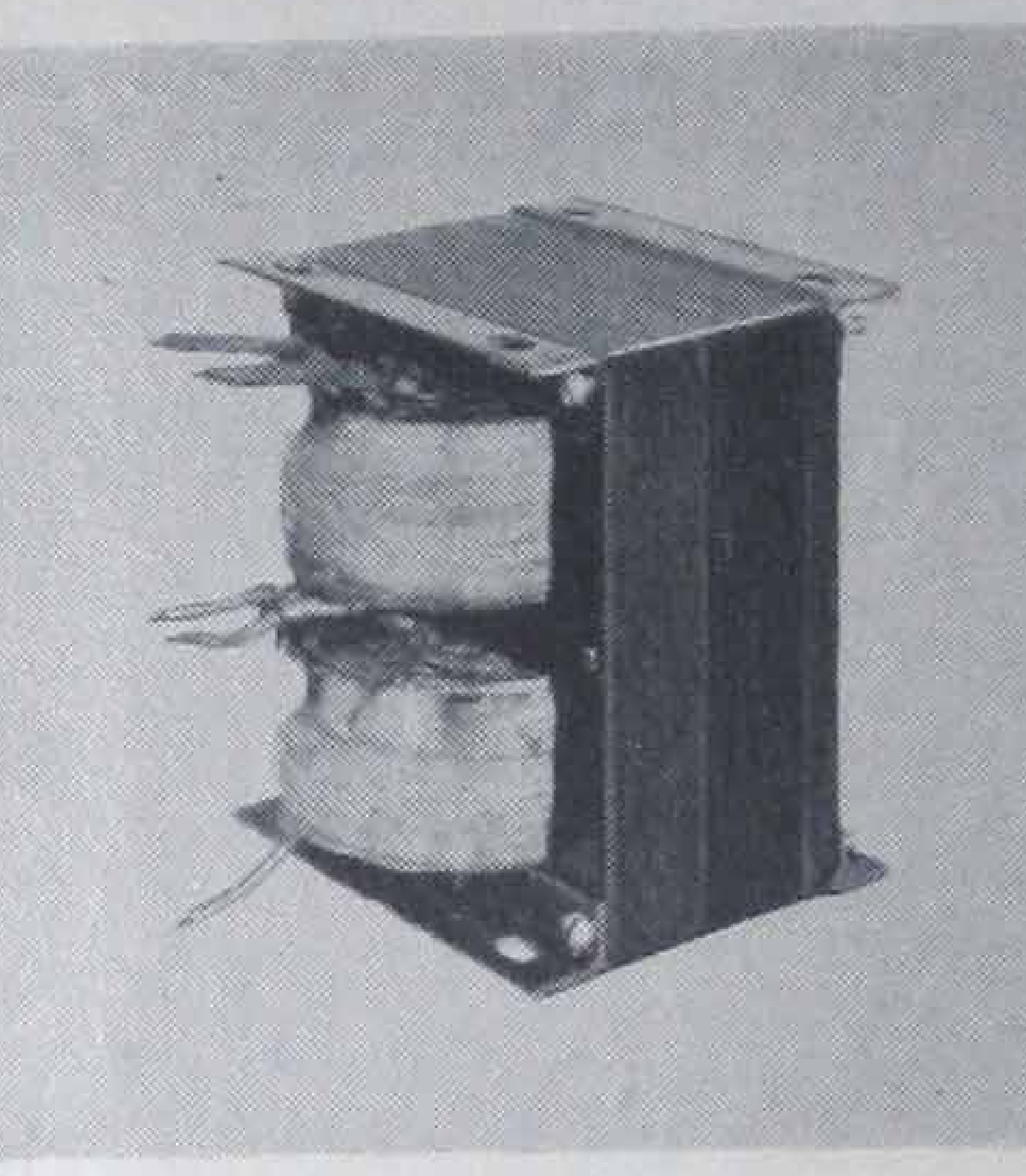
Vertical Distribution with Glassteel Diffuser

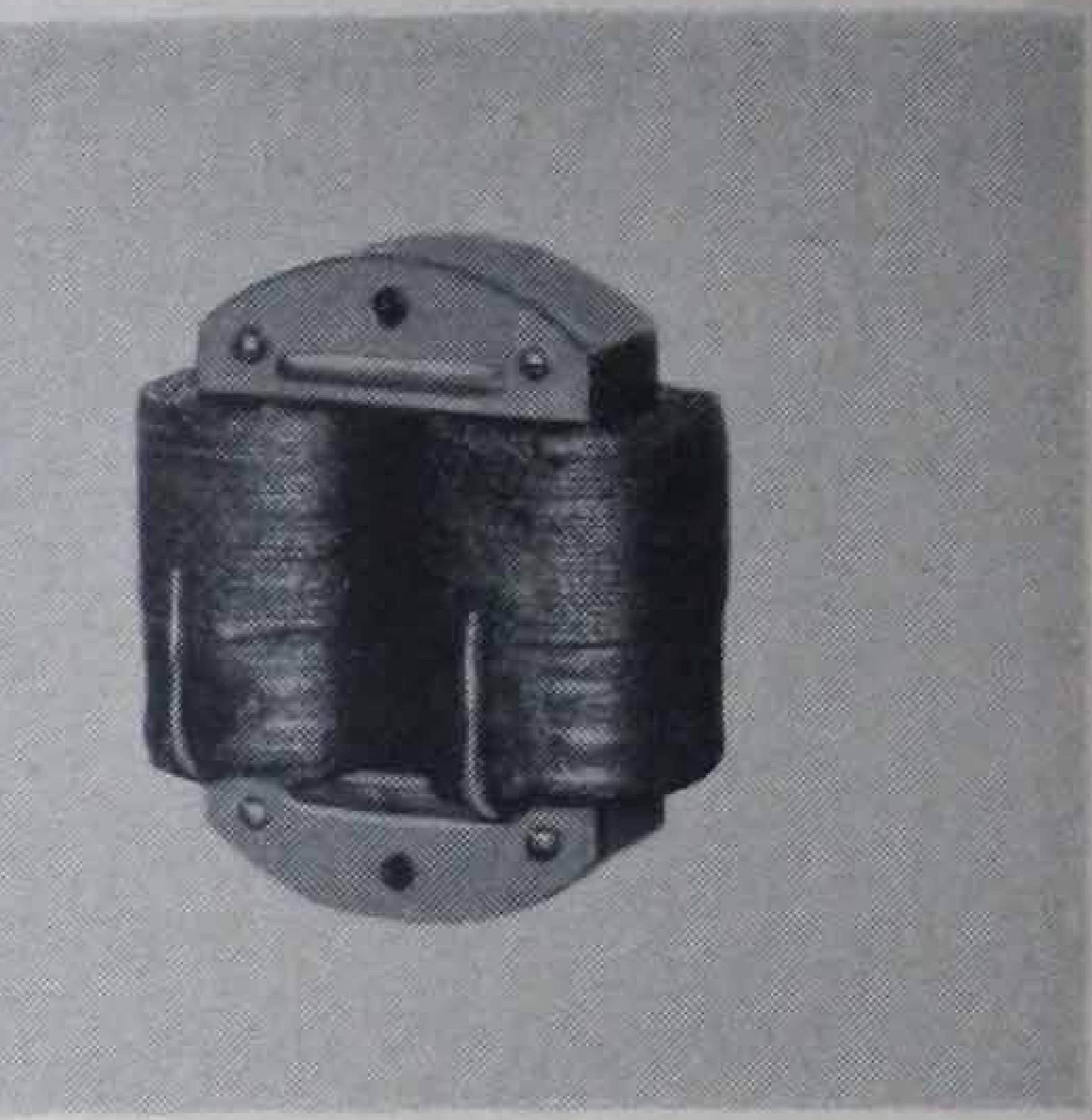
(Reprinted 4-35)

REFLECTORS AND ACCESSORIES FOR 400-WATT HIGH INTENSITY MERCURY LAMPS—Continued

Transformer-Capacitor or Reactor-Capacitor Unit


Transformer Only, or Reactor Only, in Case


Transformer Only, Bare


Reactor Only, Bare

The 400-watt High Intensity Mercury lamp will operate only on A-C. circuits, but cannot be operated directly in any existing socket on a regular multiple circuit. On account of the difference between initial starting voltage required for the lamp and the final operating voltage, a transformer with high internal reactance or a reactor must be used. The transformer or reactor acts like a valve to prevent the current of the lamp reaching too high a value as its resistance or its voltage tends to change during normal operation.

If service provides 208 to 240-volt range at the socket, then each mercury lamp should be connected in series with a reactor not too far removed from the lamp. Service of 107 to 123-volt range requires a step-up voltage transformer with high internal reactance instead of a reactor.

Because the wattage input to the lamp must be closely limited, transformers and reactors are equipped with several taps to meet all common service voltages. The nearest tap to available line voltage should always be used.

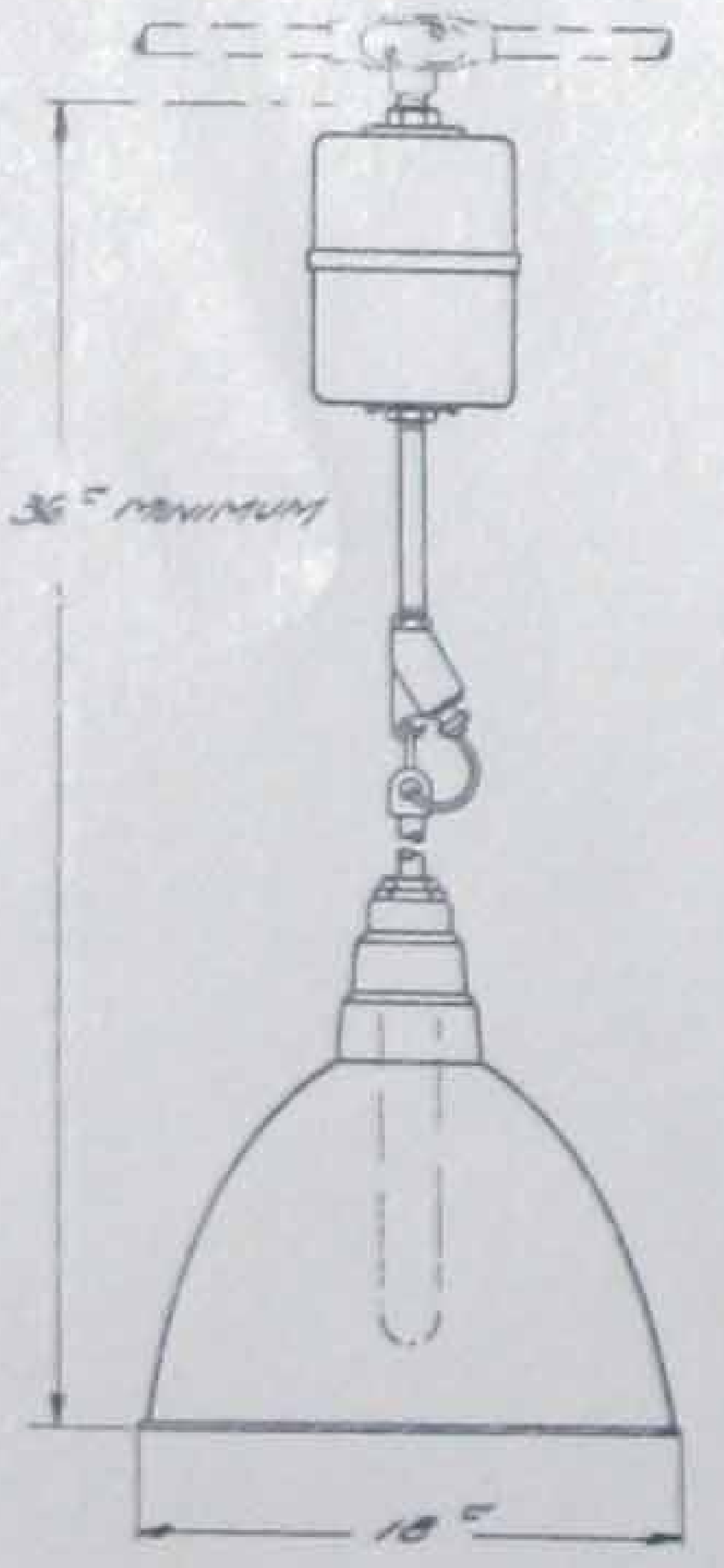
The use of a transformer with high internal reactance or a reactor to provide the necessary high starting voltage and somewhat lower operating voltage results in a reduced power factor. Therefore, Transformer-Capacitor or Reactor-Capacitor units are available to correct this condition. These consist of two-compartment cases, with the transformer or the reactor mounted in the lower compartment and the capacitor in the upper compartment to provide a power factor of 90% to 95%.

The end covers are drawn steel finished with a green baked enamel. The upper cover has attached to it a hub tapped for ¾-inch conduit through which two line leads six inches long project. A convenient form of conduit box should be attached to the hub by means of a close nipple for suspending the unit and facilitate making line connections.

The lower end of the unit is also provided with a hub tapped for ¾-inch conduit or bushed for ½-inch conduit for suspension of the lighting unit. The lower cover is so arranged that by removing two screws it can be dropped over reflector supporting stem to permit lamp connections and line tap connections to transformer or reactor in the lower compartment.

The listings appearing below include "Transformer Only, in Case" and "Reactor Only, in Case." These units are similar to the high-power-factor units, except that the capacitor is omitted.

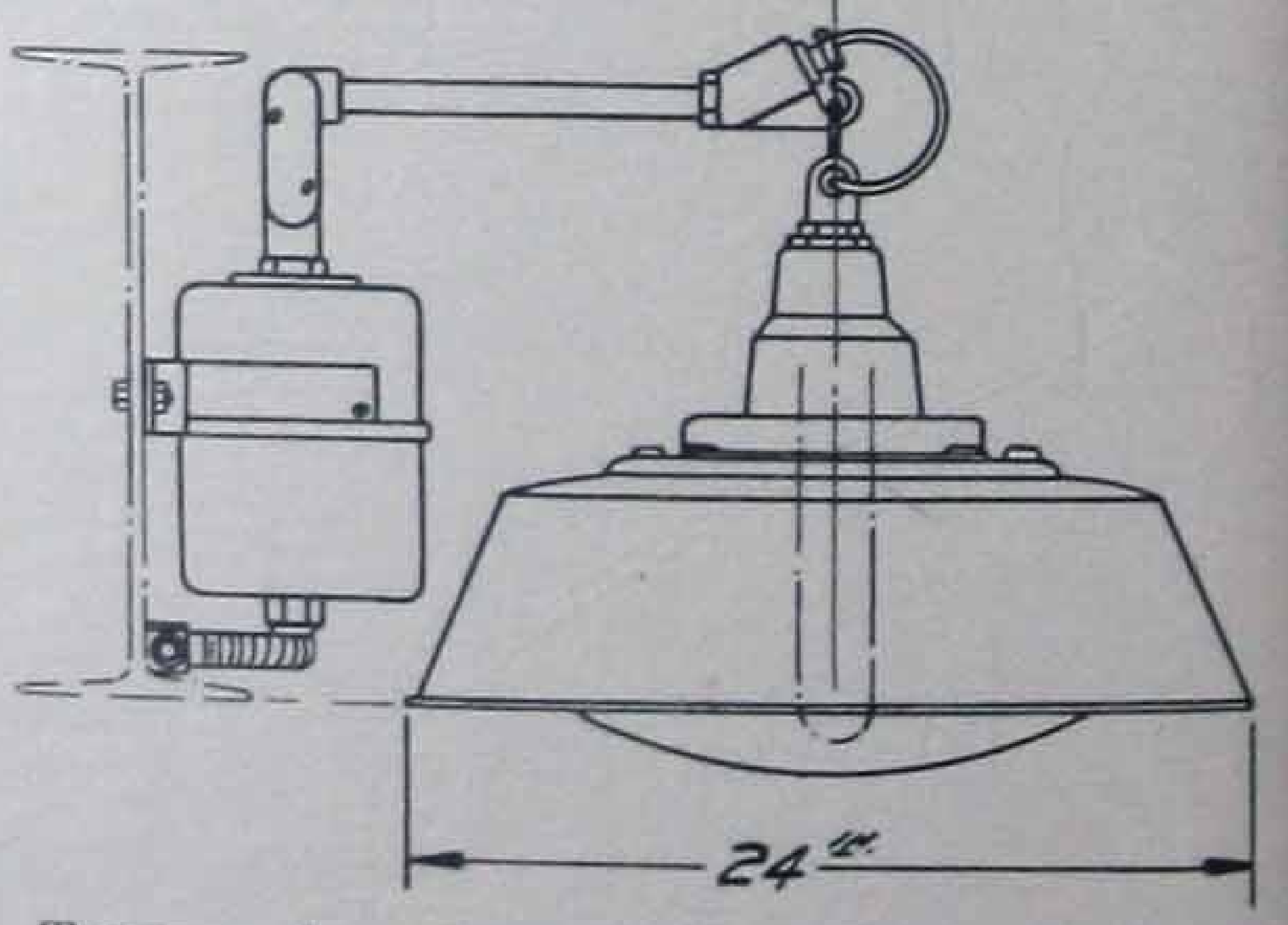
"Transformer Only—Bare" and "Reactor Only—Bare" are available for manufacturers to incorporate in their own housings. Only the transformer in "Transformer-Capacitor" unit has taps for the capacitor.



Typical Assembly of Aluminum Reflector and Current Limiting Accessory for Overhead Mounting

Description	Ship. Wt.	Style No. Lower Outlet ¾"	Style No. Lower Outlet ½"*
TRANSFORMERS FOR 107-115-123-VOLT, 60 CYCLE CIRCUITS			
Transformer-Capacitor Unit	26½	789 625	✓ 888 087
Transformer Only, in Case	24	789 689	888 088
Transformer Only, Bare	20	789 751	....
REACTORS FOR 208-220-230-240-VOLT, 60 CYCLE CIRCUITS			
Reactor-Capacitor Unit	22	789 623	888 089
Reactor Only, in Case	15	789 688	888 090
Reactor Only, Bare	11½	789 618	....
MOUNTING ACCESSORIES			
Bracket for Side Mounting of High Power Factor Units	4	789 752	

*Use these styles with fixtures or accessories tapped for ½-inch conduit.



Typical Assembly of Glassteel Diffuser Reflector and Current Limiting Accessory for Side Mounting

Printed in U.S.A.

Supplementing
Price List 61-120
Dated December 10, 1934

PRICE SUPPLEMENT 61-120
Effective March 25, 1935

INDUSTRIAL LIGHTING EQUIPMENT

FOR CATALOG SECTION 61-180

	Complete Unit Style No.	Complete Unit List Price	Description	Catalog Section	Page No.
888335 —	340 927	$ 7.25	Globe	61–180	1
	346 571	2.15	Hanger	61–180	1
✓ —	785 477	18.50	Glassteel	61–180	1
	789 585	12.50	Reflector	61–180	1
✓	789 586	12.50	Reflector	61–180	1
—	789 587	15.00	Reflector	61–180	1
	789 618	6.75	Reactor	61–180	2
	789 623	15.00	Reactor	61–180	2
✓ —	789 625	15.00	Transformer	61–180	2
	789 688	8.75	Reactor	61–180	2
	789 689	11.00	Transformer	61–180	2
	789 751	8.50	Transformer	61–180	2
	789 752	2.00	Bracket	61–180	2
—	888 087	15.00	Transformer	61–180	2
	888 088	11.00	Transformer	61–180	2
	888 089	15.00	Reactor	61–180	2
	888 090	8.75	Reactor	61–180	2

Prices are subject to change without notice

Westinghouse Electric & Manufacturing Company
Edgewater Park, Cleveland, Ohio

Printed in U.S.A.

Super
Issue
Dated

For
Price
Lists

61-120

61-220

61-310

61-410

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Dated October 1, 1934

**CONFIDENTIAL INSTRUCTIONS
AND GENERAL DISCOUNTS 61-000***
Effective March 25, 1935

INDUSTRIAL, COMMERCIAL, FLOOD, AVIATION AND ULTRA-VIOLET LIGHTING EQUIPMENT

For Price Lists			①Discounts and Multipliers				
			Trade Discount Sheet 61-001 (3–25–35)	Industrial and Commercial Users Discount Sheet 61-002 (3–25–35)	Dealers Cost Sheet 61-003 (3–25–35)	Contract Discount Sheet 61-009 (3–25–35)	Special-Jobber Cost Sheet 61-006 (3–25–35)
61-120	**‡Industrial Lighting Equipment (Except Mercury Lamp Transformers)**						
	Less than standard package	Disc.	Net	10%	20%	20%	25%
		Mult.	1.00	.90	.80	.80	.75
	1–4 standard packages	Disc.	Net	25%	33%	33%	37%
		Mult.	1.00	.75	.67	.67	.63
	5 or more standard packages	Disc.	Net	32%	39%	39%	42%
		Mult.	1.00	.68	.61	.61	.58
	①Mercury Lamp Transformers						
	1 to 9 Transformers	Disc	Net	Net	7.5%	7.5%	10%
		Mult.	1.00	1.00	.925	.925	.90
	10 to 99 Transformers	Disc.	Net	Net	10%	10%	15%
		Mult.	1.00	1.00	.90	.90	.85
	100 or over Transformers	Disc.	10%	10%	10%	10%	20%
		Mult.	.90	.90	.90	.90	.80
61-220	**Commercial Lighting Equipment**	Disc.	25%	25%	50%	55%	62.5%
		Mult.	.75	.75	.50	.45	.375
61-310	**†Macbeth Lighting Glassware**						
	Less than standard package	Disc.	Net	Net	25%	25%	37.5%
		Mult.	1.00	1.00	.75	.75	.625
	Standard package or more	Disc.	25%	25%	50%	50%	62.5%
		Mult.	.75	.75	.50	.50	.375
61-410	**Floodlighting Equipment**						
	Mine Locomotive Headlights	Disc.	25%	30%	30%	30%	35%
		Mult.	.75	.70	.70	.70	.65
61-820	Floodlights and Searchlights	Disc.	33%	40%	40%	40%	46%
		Mult.	.67	.60	.60	.60	.54
61-520	**Ultra-Violet Floor Lamps**	Disc.	Net	Net	40%	40%	50%
		Mult.	1.00	1.00	.60	.60	.50
61-920	**Aviation Lighting Equipment**	Disc.	50%	50%	55%	50%	60%
		Mult.	.50	.50	.45	.50	.40

U. S. Government Discounts—Dealer Discounts Apply (Except Ultra-Violet Equipment—Trade Discounts Apply).

‡The Industrial Lighting Equipment standard package quantity for billing purposes is 10 unless otherwise specified in the price list. Assortment of materials consisting of reflectors, sockets, guards, etc. is permitted in making up quantities to obtain maximum permissible discounts but must include at least one unbroken standard package of REFLECTORS OR COMPLETE LIGHTING FIXTURES to entitle purchaser to "1-4 standard package" discounts on any of these items, or at least five unbroken standard packages of REFLECTORS OR COMPLETE LIGHTING FIXTURES to entitle purchaser to "5 or more standard packages" discounts.

†The Macbeth Lighting Glassware standard package quantities are listed in Price List 61-310.

Price and discounts are subject to change without notice.

Method of Calculating Prices on Lighting Equipment

Quoted prices shall be figured as units to the even cent, dropping all mils, and lump sum prices shall be obtained by multiplying the unit price by the number of units.

Equipment with Incandescent Lamps

Prices on lighting equipment do not include incadescent lamps unless so specified in the catalog.

Where prices are required with lamps, the lamps shall be shown as a separate item at their proper net prices.

Where specifications require that lamps and equipment be combined, the price quoted shall be the net price of the equipment, plus the manufacturer's list price of lamps with no discount for standard packages or otherwise.

***This sheet is distributed to Agent-Jobbers.**

①This sign denotes change from previous issue.

Westinghouse Electric & Manufacturing Company
Edgewater Park, Cleveland, Ohio

①TERMS

Industrial Lighting Equipment (Except Mercury Lamp Transformers)

Floodlighting Equipment

Net 30 days; or 2% in 10 days provided no past due items remain unpaid, on the basis of settlement twice a month—that is, invoices from the 1st to the 15th, on or before the 25th; invoices from the 16th to the last day of the month, on or before the 10th of the following month.

Note—For brevity, "2% ten days; net 30 days" may be used on orders.

Commercial Lighting Equipment
Mercury Lamp Transformers
Aviation Lighting Equipment

Net 30 days.

Macbeth Lighting Glassware

1% 15 days; net 30 days.

Ultra Violet Floor Lamps

East of Denver, 2% 10 days; net 30 days; Denver and west, net 60 days.

①DELIVERY

Industrial Lighting Equipment (Except Mercury Lamp Transformers)

Freight shipments—Orders 100 pounds or over—f.o.b. point of shipment with freight allowed to destination including delivery service (store door delivery) where common carrier provides such service.

Orders less than 100 pounds—f.o.b. point of shipment.

Express and parcel post shipment—f.o.b. point of shipment. Where express or parcel post charge exceeds freight expense an amount equal to freight expense will be allowed. Where express or parcel post charge is less than freight expense the express or parcel post charge will be allowed.

Mercury Lamp Transformers

F.o.b. Cleveland, Ohio.

Commercial Lighting Equipment

Glassware—f.o.b. Charleroi, Penna.

All other—f.o.b. Cleveland, Ohio.

Where freight shipments on an order are made from both Cleveland and Charleroi, and the shipment from either point is less than 100 pounds, freight on the less than 100 pounds shipment will be charged at 100 pounds minimum.

Macbeth Lighting Glassware

F.o.b. Charleroi, Pennsylvania.

Floodlighting Equipment
Ultra-Violet Floor Lamps

Freight shipments—f.o.b. point of shipment with freight allowed to destination including delivery service (store door delivery) where common carrier provides such service.

Express and parcel post shipments—f.o.b. point of shipment. Where express or parcel post charge exceeds freight expense an amount equal to freight expense will be allowed. Where express or parcel post charge is less than freight expense, the express or parcel post charge will be allowed.

Aviation Lighting Equipment

Zone 1 (See map, page 3.)

Freight shipments—f.o.b. point of shipment with freight allowed to destination, including delivery service (Store door delivery) where common carrier provides such service.

Express and parcel post shipments—f.o.b. point of shipment, where express or parcel post charge exceeds freight expense, an amount equal to freight expense will be allowed. Where express or parcel post charge is less than freight expense the express or parcel post charge will be allowed.

Zones 2 and 3 (See map, page 3.)

Freight shipments—f.o.b. point of shipment with 1% of list in zone 2 and 2.5% of list in zone 3 charged in lieu of freight charges.

Express and parcel post shipments—f.o.b. point of shipment. Where express or parcel post charge exceeds freight expense, the express or parcel post shall be charged in addition to the zone freight charge and an amount equal to regular freight expense will be allowed. Where express or parcel post charge is less than freight expense, the zone freight charge will be made and the express or parcel post charge will be allowed.

CLASSES OF PURCHASERS

Class 61-001—Trade

This class includes individuals and all other purchasers not included in any of the following classes. Trade Discount Sheet 61-001 will apply.

Class 61-002 Industrial and Commercial Users

This class includes manufacturing establishments, commercial establishments or organizations, and institutions in which the maintaining, servicing or repairing of existing installations is performed by their own permanent employee or employees who are qualified to perform electrical maintenance work and are regularly and continuously employed for this purpose. Industrial and Commercial Users Discount Sheet 61-002 will apply.

Class 61-003—Dealers

This class includes electrical contractors and dealers who purchase for resale. Dealers Cost Sheet 61-003 will apply. In the future, industrial electrical contractors, or Westinghouse Lighting Dealers who include industrial, commercial and floodlighting in their agreement will be given Dealers Cost Sheet 61-003 except on commercial lighting equipment on which they may be extended Contract Discount Sheet 61-009 and excepting in those cases where the customer may qualify under one of the following classifications. Authorization for other classification must be secured from Sales Manager, Central Station Department, East Pittsburgh.

Class 61-006—Special-Jobbers

This class includes authorized special-jobbers. Special-Jobber Cost Sheet 61-006 will apply, which is to be distributed only to Special-Jobber officials and interested Westinghouse employees.

Class 61-007—Agent-Jobbers

This class includes all Westinghouse Electric Supply Company branches and authorized Agent-Jobbers. Agent-Jobber Cost Sheet 61-007 will apply, which is to be distributed only to Westinghouse Electric Supply Company officials, Agent-Jobber officials and interested Westinghouse employees.

Class 61-009—Contract

This class includes central station syndicates, electric railway syndicates, steam railway syndicates and industrial syndicates who have included Industrial, Commercial, Flood, Aviation or Ultra-Violet Lighting Equipment in their annual purchase agreement. Contract Discount Sheet 61-009 will apply.

Oil Producing or Distributing Companies Operating Fifty (50) or More Service Stations or Tire Manufacturers Operating Their Own Service Stations.

Such customers may be given Dealers Discounts on floodlights and searchlights, Price List 61-820. When these customers are scheduled to receive this special authorization, notification should be given to Headquarters and all invoicing points by Form 7119.

① This sign denotes change from previous issue.

Resale Manufacturers

Manufacturers purchasing equipment to be resold in connection with a product of their own manufacture may be extended Special Jobber Discounts.

Governments

Federal and State—Dealers Cost Sheet 61-003 will apply, except for Ultra-Violet Equipment (Price List 61-520), Trade Discount Sheet 61-001 will apply.

County and Municipal—Dealers Cost Sheet 61-003 will apply, except Ultra-Violet Equipment (Price List 61-520) and Aviation Lighting Equipment (Price List 61-920), Trade Discount Sheet 61-001 will apply.

Educational Institutions

Trade Discount Sheet 61-001 will apply except for Industrial Lighting Equipment, Price List 61-120, use Dealers Discount Sheet 61-003. For definitions and instructions covering Educational Institutions, refer to Confidential Instruction Sheet 190.

GLASSTEEL DIFFUSERS

Glassteel Diffusers are licensee material and will be sold only as complete units. The pricing information as given for this equipment will apply without exception. Special sockets to match the reflectors have been provided and orders for Glassteel Reflectors only without sockets will not be accepted.

Globes may be ordered at the regular prices for replacement purposes.

RETURNED MATERIAL

The return of apparatus for credit or exchange will not be permitted without first obtaining written approval with shipping instructions from the Sales Office through which the order was placed. Such requests must be made within four months from date of shipment.

Credit adjustments shall be based on net selling price less transportation charges and restocking expenses of not less than 10% of the net selling price, the minimum restocking charge being 50 cents.

Ultra-Violet Floor Lamp Servicing and Repair—Inoperative ultra-violet lamp bulbs should be returned to WESCO houses or Agent-Jobbers and immediate replacement made. The inoperative bulbs being placed in the "defective lamp box" for return to Bloomfield for credit, in accordance with regular practice. Request for credit or replacement on bulbs should not be referred to Cleveland Works.

Floor lamp standards which become inoperative within the guarantee period or which are to be repaired and returned to customers, shall be returned to Cleveland Works, accompanied by a report giving cause of failure. The shipment adjusting the case will be made on a Cleveland Works order of the X series resulting from factory inspection.

ULTRA-VIOLET FLOOR LAMP ADVERTISING ALLOWANCE

An advertising allowance of $2.00 net on the S-1 floor lamp and $1.00 net on the S-2 and G-5 floor lamps will be made to contractors, central stations, department stores or Jobbers upon receipt of a debit memorandum with copy of advertisement attached and invoices covering sales as the result of this advertising. This debit memorandum should be sent to Westinghouse Electric & Manufacturing Company, Cleveland Works, monthly.

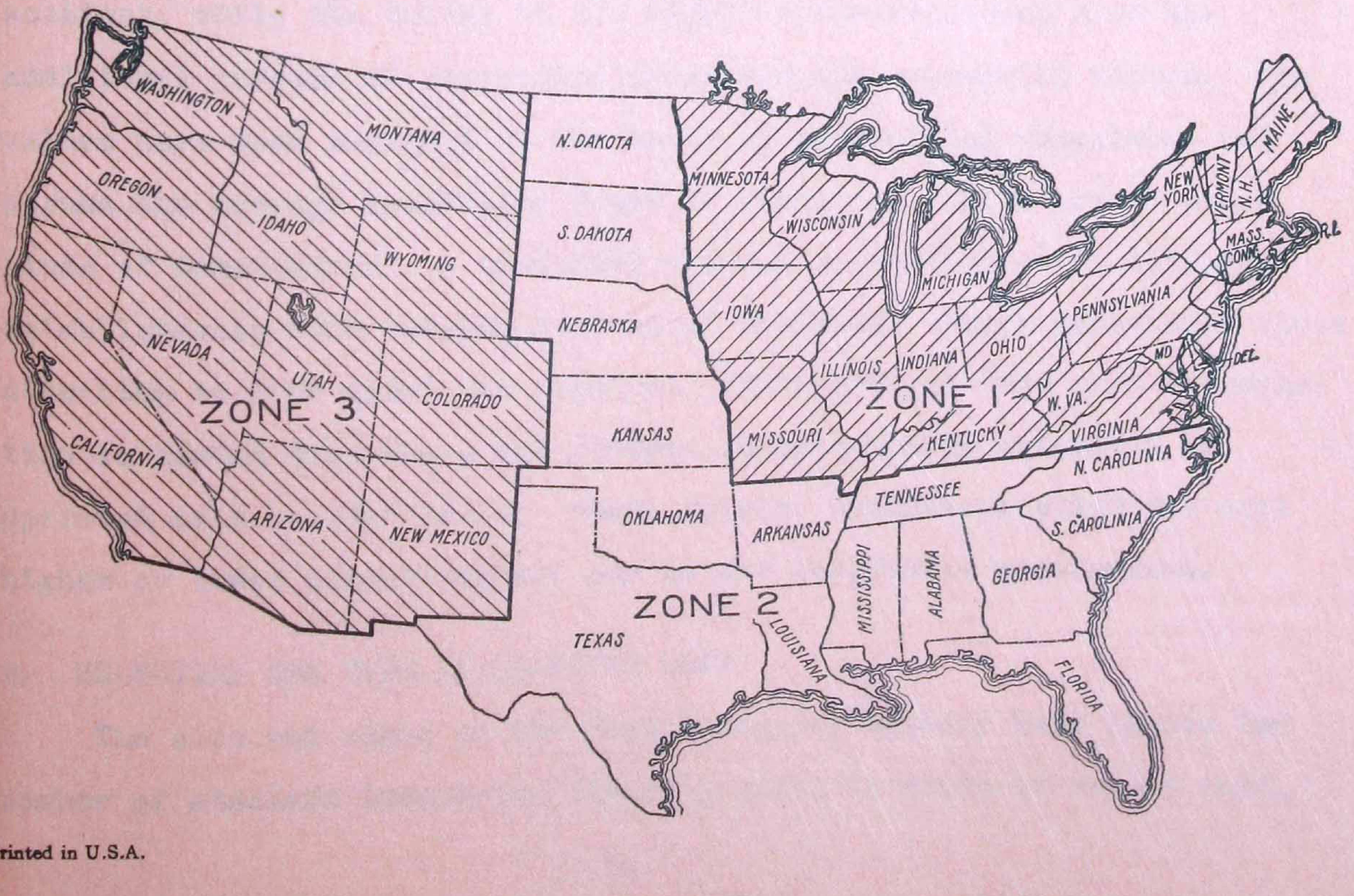
GUARANTEE

All apparatus listed is guaranteed against mechanical and electrical defects for one year from date of purchase. Repair or replacement of material only shall constitute fulfillment of all Company obligations with respect to this guarantee.

CONDITIONS

The Company will not be responsible or liable for any loss, damage, detention or delay caused by fire, strike, civil or military authority, or by insurrection or riot, or by any other cause which is unavoidable or beyond its reasonable control; nor in any event for consequential damages.

ZONE MAP



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DESIGNING THE INSTALLATION

A very simple method has been devised for designing industrial lighting installations where Westinghouse High Intensity Mercury Vapor lamps are to be used.

The procedure is divided into five steps which are fully explained on the following pages.

1. Decide the foot-candle illumination required. Refer to Table I.
2. Select the type of lighting unit best adapted to the location and the activity to be performed as outlined under Section 2.
3. Decide the Conditions Factor. Refer to Table II for rating.
4. From Table III, determine the required spacing of the units to produce the desired illumination.
5. Check capacity of wiring. Refer to Table IV.

1. DECIDING THE FOOT-CANDLE ILLUMINATION REQUIRED.

In Table I, the foot-candle values in the lower classifications are required principally to enable employees to see well enough to avoid accident, while the values in the higher classifications have the additional purpose of preventing eyestrain and conserving vision. The values have been assigned on the basis of engineering experience and assume the average conditions found in practice. There are no sharp lines of demarcation. A specified process is carried on in different establishments with varying degrees of fineness. Where especially close attention to fine detail is required, it is obvious that more illumination is needed than where the process is essentially automatic or operated on a coarser scale. Where special conditions exist the next higher or lower classification may be the reasonable requirement.

2. SELECTING THE TYPE OF LIGHTING UNIT

The size and snape of the High Intensity Mercury lamp limits the number of standard industrial lighting units in which it can be used.

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The two most suitable units are the 24" Glassteel Diffuser and the 18" High Mounting Reflector.

GLASSTEEL DIFFUSER

The Glassteel Diffuser consists of a diffusing glass globe and a white porcelain enameled reflector which directs most of the light downward. The glass globe conceals the bright light source, thereby minimizing glare and softening shadows. The reflector has six openings at the top which permit some light to reach the ceiling, thus reducing the contrast between the ceiling and lighting unit which also helps to reduce glare.

The Westinghouse Electric & Manufacturing Co. manufactures several lighting units which are designed to be used with the Westinghouse High Intensity Mercury lamp.

A unit designed to be used in the usual industrial interior (W.E. & M.Co. Catalog Section 60-180) consists of a Glassteel Diffuser and a Current Limiting Accessory connected together by a Quick-Change Hanger. Where the unit is used on a 110 volt circuit the Current Limiting Accessory is a Transformer. Where the unit is to be used on a 220 volt circuit the Current Limiting Accessory is a Reactor.

In general the Glassteel Diffuser should be used where the mounting height is less than 18 ft.

HIGH MOUNTING REFLECTOR

The High Mounting Reflector consists of an aluminum spun reflector with an etched surface. A complete unit consisting of High Bay Reflector and Current Limiting Accessory connected together by a Quick-Change Hanger is available. (W.E. & M.Co. Catalog Section 61-180). For use on 110 volt circuits the Current Limiting Accessory is a Transformer. Where the unit is to be used on 220 volts a Reactor is furnished.

In general the High Mounting Reflector should be used where the mounting height exceeds 18 ft. If mounted lower than 18 ft. glare probably will be objectionable.

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3. DETERMINING THE CONDITIONS FACTOR

Lighting equipment must be fashioned to conform with the physical characteristics of a room just as a suit of clothes must be fitted to the physical characteristics of an individual. A room must be appraised first from the standpoint of its general proportions; second, from the color and the material of the walls and ceiling; and third, from the standpoint of its situation, whether it is located where dust, dirt, soot, smoke, or other similar elements are present which would tend to collect on, or in, the lighting units and thereby reduce efficiency. A simple table, Table II, has been prepared which gives a general summary of these conditions, and should be used to determine the Conditions Factor.

PER CENT LIGHT REFLECTED FROM
TYPICAL WALLS AND CEILINGS

SURFACE	CLASS	COLOR	LIGHT REFLECTED PER CENT
Paint	Light	White	81
"		Ivory	79
"		Cream	74
Caen Stone		Cream	69
Paint	Medium	Buff	63
"		Light Green	63
"		Light Gray	58
Caen Stone		Gray	56
Paint	Dark	Tan	48
"		Dark Gray	26
"		Olive Green	17
"		Light Oak	32
"		Dark Oak	13
"		Mahogany	8
Cement		Natural	25
Brick		Red	13

Note first of all the general proportions of the room, whether its width is approximately equal to or is twice, three or four times the ceiling height.

Now note the color of the walls and ceiling. The illumination in any room is dependent upon the amount of light reflected from the walls and ceiling. White walls reflect more light than gray walls - gray walls reflect more light than black walls. Therefore, in appraising the color of the walls and ceiling three general classifications are used: light, medium, dark.

The table on this page gives some idea of the colors in these three classifications and of their different reflecting qualities.

After noting the general proportions of the room, the second step in selecting a Conditions Factor is to determine whether the walls and ceiling are light, medium or dark. The third and final step is to decide whether or not the air is clean or subject to dusty, sooty or smoky conditions. This third consideration is referred to as a maintenance

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condition in that it has to do with the maintenance of the lighting unit. There is no definite table or guide to go by in selecting this condition except observation. This condition is classified as either Very Good or Fair.

Now, by referring to Table II, with the room proportions in mind, with the classification of Light, Medium or Dark for color of the walls and ceiling, and Very Good or Fair for maintenance, the Conditions Factor can be easily determined. This factor is not a numerical one, but is given in terms of "Favorable", "Average" and "Unfavorable".

4. DECIDE MOUNTING HEIGHT AND SPACING - DETERMINE THE SIZE OF LAMPS

The first step is to determine whether the existing ceiling outlets in the room are properly located so that if a reflector is installed at each outlet an evenly distributed illumination over the room will be obtained. The allowable spacing between outlets is dependent upon the mounting height of the luminaires. The mounting height is the distance from the floor to the bottom of the reflector. A good rule to follow is that the spacing between units should be approximately equal to the mounting height and in no case should the spacing be more than 1½ times the mounting height if an even distribution of light is desired. The distance from the wall to the first outlet should be approximately ½ the distance between units. Twelve feet is a desirable mounting height to work toward in most industrial interiors. In some cases, notably where there are travelling cranes, the units must be mounted considerably higher.

After the outlets have been located and the total number determined the "Area per Outlet" is easily found by dividing the total floor area by the number of outlets.

$$\text{Area per Outlet} = \frac{\text{Total Area}}{\text{Number of Outlets}}$$

Now, glance down the column marked "Area per Outlet" to the figure just determined. To the right in the column headed "Conditions Factor"

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select the factor previously determined (Favorable, Average or Unfavorable). Following horizontally to the right on this line the illumination in foot-candles which will be provided will be found in the "Average Foot-candles" column.

5. CHECK CAPACITY OF WIRING

Excessive voltage drops in wiring should be avoided because they represent power losses. Wire which may be of sufficient size to pass the Underwriter's requirements and quite safe from the standpoint of fire hazard may not be adequate to avoid an excessive voltage drop. It is recommended that wire sizes be computed for not over a 2 volt drop from panel to the farthest outlet on any circuit. For correct wire sizes to meet required capacities refer to Table IV.

Where the voltage available is within the range of 208-240 volts, the 400 watt High Intensity Mercury lamp is operated in series with a reactor. If no condenser is provided to correct the power factor, the starting current is 6 amperes per lamp. If the power factor is corrected the current per lamp is 4.5 amperes.

Where the service voltage is within the range of 107-123 volts, the lamp is operated on a transformer. If the power factor is not corrected the starting amperes per lamp are 10. If the power factor is corrected, each lamp draws 8 amperes during the starting period.

EXAMPLE

It is desired to illuminate a machine shop, (Figure 1), in which medium machine work is done. The ceiling height is 13 feet. The ceiling and walls are dark in color and the maintenance is only fair.

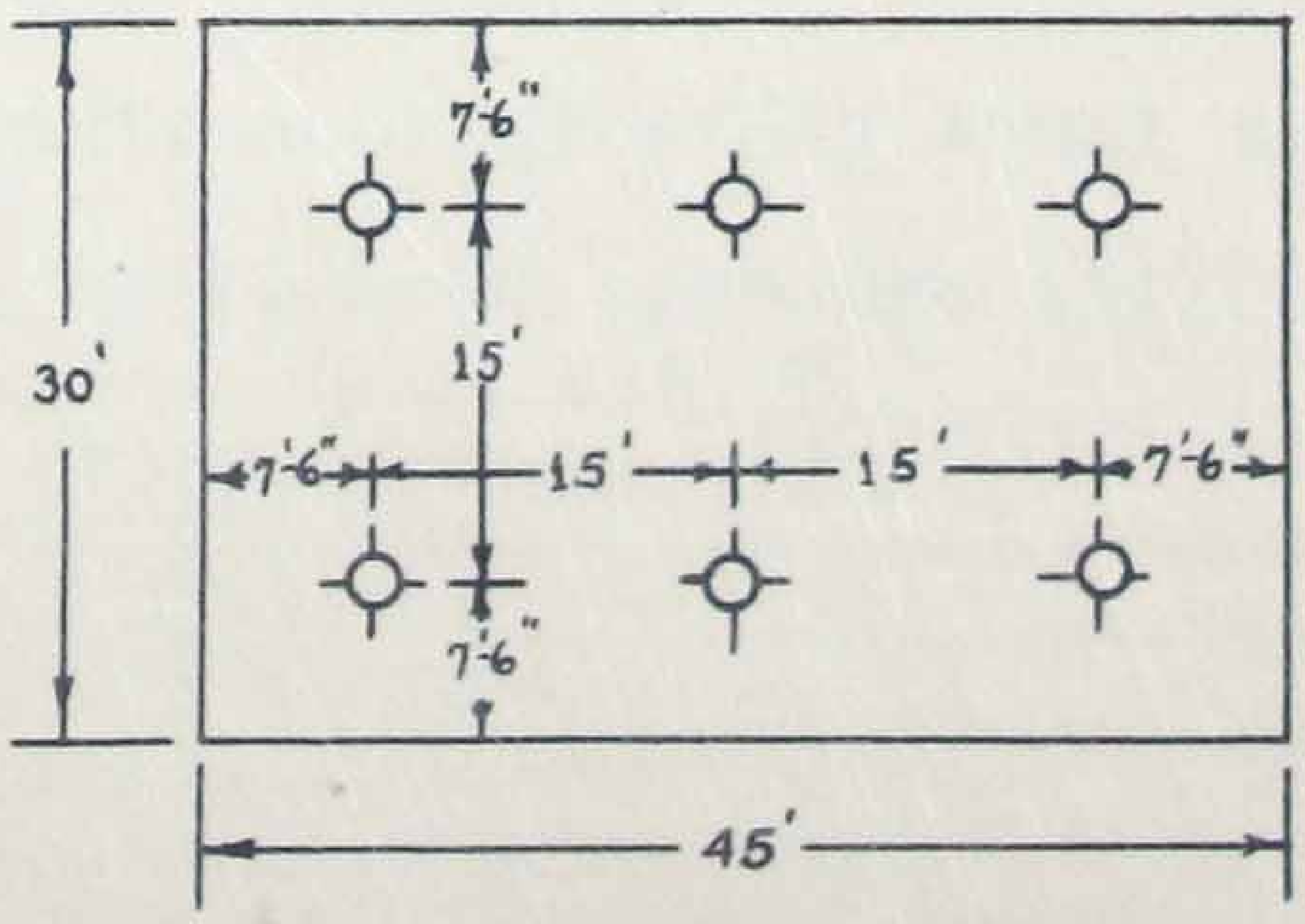

Figure 1

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SOLUTION

1. Decide the illumination required. Referring to Table I under Machine Shops it will be found that 10 - 20 foot-candles are required for medium machine work. It is therefore decided to provide 15 foot-candles in this shop.
2. Select the lighting unit. The ceiling height is 13 feet so the units must be mounted lower than 20 feet. The Glassteel Diffuser will therefore be used. It is desirable to mount the units as high above the floor as possible to reduce glare and give a more uniform light distribution.
3. Decide the conditions factor. The width of the room is approximately twice the ceiling height. The ceiling and walls are dark and the maintenance is fair. Using these data and referring to Table II the conditions factor is found to be "Unfavorable".
4. Determine spacing of lighting units. Refer to Table III-A which contains the data applying to Glassteel Diffusers. Running down the column headed "Average Foot-candles" it is found that with a conditions factor of "Unfavorable", 13 - 16 foot-candles will be provided with a spacing of 14¾ x 14¾ feet. Since it is decided to provide 15 foot-candles, the spacings should be 14 or 15 feet. This spacing will be satisfactory as far as distributing the light uniformly is concerned since it is less than one and a half times the mounting height.

Draw a simple floor plan of the room to scale (Figure 1), and on it lay out the units symmetrically, using a spacing of 14 or 15 feet. Make the distance from the wall to each unit approximately equal to the distance between units. Six units on 15 by 15 feet spacings will be required.

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TABLE I

ILLUMINATION REQUIRED AT THE WORK

Foot-candles

WHERE DISCRIMINATION OF DETAIL IS NOT ESSENTIAL.................... 2-5
Handling material of a course nature; grinding clay products; rough sorting; coal and ash handling; foundry charging.

WHERE SLIGHT DISCRIMINATION OF DETAIL IS ESSENTIAL................. 5-10
Rough machining; rough assembling; rough bench work; rough forging; grain milling.

WHERE MODERATE DISCRIMINATION OF DETAIL IS ESSENTIAL.............. 10-20
Medium bench and machine work; fine molding and core making; newspaper printing.

WHERE CLOSE DISCRIMINATION OF DETAIL IS ESSENTIAL................. 20-30
Tool making; weaving; stitching and trimming.

WHERE VERY CLOSE DISCRIMINATION OF DETAIL IS ESSENTIAL............ 30-50
Electrotyping; glass cutting; polishing and inspecting.

WHERE DISCRIMINATION OF MINUTE DETAIL IS ESSENTIAL................ 50-100
Fine bench and machine work; fine inspecting; typesetting, engraving.

TABLE II

CONDITIONS FACTORS			
Proportions of Room	Color of Ceiling and Sidewalls	Maintenance of Equipment	
		Very Good	Fair
Width Approximately Four or More Times Ceiling Height	Light	Favorable	Favorable
	Medium	Favorable	Favorable
	Dark	Favorable	Average
Width Approximately Twice Ceiling Height	Light	Favorable	Average
	Medium	Favorable	Average
	Dark	Average	Unfavorable
Width Approximately Equal to Ceiling Height	Light	Average	Unfavorable
	Medium	Unfavorable	Unfavorable
	Dark	Unfavorable	Unfavorable

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TABLE III-A

GLASSTEEL DIFFUSER

The Units should be mounted above the floor a distance approximately equal to the spacing between units. They should not be mounted lower than 10 feet or spaced more than 1½ times the mounting height.

Approximate Spacing (Feet)	Area per Outlet (Sq.Ft.)	Conditions Factor	Average Foot-candles
8½ x 8½	65 - 75	Favorable	64-80
		Average	48-59
		Unfavorable	37-48
9 x 9	75 - 85	Favorable	57-73
		Average	43-56
		Unfavorable	34-43
9½ x 9½	85 - 95	Favorable	51-64
		Average	37-52
		Unfavorable	30-37
10 x 10	95 - 110	Favorable	48-61
		Average	34-48
		Unfavorable	30-34
11 x 11	110 - 125	Favorable	40-50
		Average	30-40
		Unfavorable	24-30
11½ x 11½	125 - 145	Favorable	34-45
		Average	27-34
		Unfavorable	21-27
12½ x 12½	145 - 170	Favorable	31-39
		Average	24-31
		Unfavorable	19-24
13½ x 13½	170 - 200	Favorable	27-34
		Average	19-27
		Unfavorable	15-19
14¾ x 14¾	200 - 230	Favorable	22-28
		Average	16-22
		Unfavorable	13-16
15½ x 15½	230 - 260	Favorable	19-25
		Average	15-19
		Unfavorable	12-15
16¾ x 16¾	260 - 300	Favorable	18-22
		Average	13-18
		Unfavorable	10-13
18 x 18	300 - 340	Favorable	15-18
		Average	12-15
		Unfavorable	9-12
19 x 19	340 - 390	Favorable	13-16
		Average	10-13
		Unfavorable	8-10
20½ x 20½	390 - 440	Favorable	12-15
		Average	9-12
		Unfavorable	7- 9
21¾ x 21¾	440 - 500	Favorable	9-12
		Average	7- 9
		Unfavorable	6- 7

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TABLE III-B

HIGH MOUNTING REFLECTORS

The Units should be mounted above the floor a distance approximately equal to the spacing between units. They should not be mounted lower than 20 feet or spaced more than 1½ times the mounting height.

Approximate Spacing (Feet)	Area per Outlet (Sq.Ft.)	Conditions Factor	Average Foot-candles
20 x 20	390 - 440	Favorable Average Unfavorable	15-18 12-15 9-12
21¾ x 21¾	440 - 490	Favorable Average Unfavorable	13-16 11-13 8-11
22½ x 22½	490 - 540	Favorable Average Unfavorable	12.5-15.0 10.0-12.5 7.5-10.0
24 x 24	540 - 590	Favorable Average Unfavorable	11.0-13.5 9-11 6.5-9.0
25 x 25	590 - 640	Favorable Average Unfavorable	10.5-12.5 8.5-10.5 6.0-8.5
26 x 26	640 - 690	Favorable Average Unfavorable	9.5-11.5 8.0-9.5 6-8
27 x 27	690 - 740	Favorable Average Unfavorable	9-11 7-9 5.5-7.0
28 x 28	740 - 790	Favorable Average Unfavorable	8.5-10.0 6.5-8.5 5.0-6.5
28½ x 28½	790 - 840	Favorable Average Unfavorable	8.0-9.5 6-8 5-6
29½ x 29½	840 - 890	Favorable Average Unfavorable	7.5-9.0 6.0-7.5 4.5-6.0
30 x 30	890 - 940	Favorable Average Unfavorable	7-8 5.5-7.0 4.0-5.5
31 x 31	940 - 990	Favorable Average Unfavorable	6.5-8.0 5.0-6.5 4-5
32 x 32	990 -1040	Favorable Average Unfavorable	6.0-7.5 5-6 4-5
32½ x 32½	1040 -1090	Favorable Average Unfavorable	6-7 5-6 3.5-5.0
33 x 33	1090 -1140	Favorable Average Unfavorable	5.5-7.0 4.5-5.5 3.5-4.5

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TABLE IV

BRANCH CIRCUIT AND FEEDER WIRE SIZES FOR VARIOUS LENGTHS OF RUN

On short runs, where voltage drop does not affect wire size, the table shows minimum permissible commercial size Brown & Sharpe gauge rubber covered copper wire according to the National Electrical Code.

Based on
- Two Per Cent Loss in Voltage on 110-volt, 2-wire circuits.
- One Per Cent Loss in Voltage on 220-volt, 2-wire circuits.
- One Per Cent Loss in Voltage on 110/220-volt, 3-wire circuits.

Wattage Load 115 volt Circuit	Amp. Load	Length of Run in Feet								Length of Run in Feet									
		30	40	50	60	70	80	90	100	120	140	160	180	200	240	280	320	360	400
575	5	14	14	14	14	14	14	12	12	12	10	10	10	10	8	8	8	6	6
690	6	14	14	14	14	14	12	12	12	10	10	10	8	8	8	8	6	6	6
805	7	14	14	14	14	12	12	12	10	10	10	8	8	8	6	6	6	6	4
920	8	14	14	14	12	12	12	10	10	10	8	8	8	8	6	6	6	4	4
1,035	9	14	14	12	12	12	10	10	10	8	8	8	8	6	6	6	4	4	4
1,150	10	14	14	12	12	10	10	10	10	8	8	8	6	6	6	4	4	4	4
1,380	12	14	12	12	10	10	10	8	8	8	8	6	6	6	4	4	4	4	2
1,610	14	14	12	10	10	10	8	8	8	6	6	6	6	4	4	4	2	2	2
1,840	16	12	12	10	10	8	8	8	8	6	6	6	4	4	4	2	2	2	2
2,070	18	12	10	10	8	8	8	8	6	6	6	4	4	4	4	2	2	2	1
2,300	20	12	10	10	8	8	8	6	6	6	4	4	4	4	2	2	2	1	1
2,875	25	10	10	8	8	6	6	6	6	4	4	4	2	2	2	1	1	0	0
3,450	30	8	8	8	6	6	6	6	4	4	4	2	2	2	1	1	0	0	00
4,025	35	8	8	6	6	6	4	4	4	4	2	2	2	1	1	0	00	00	000
4,600	40	6	6	6	6	4	4	4	4	2	2	2	1	1	0	00	00	000	000
5,175	45	6	6	6	6	4	4	4	2	2	2	1	1	0	00	00	000	000	4/0
5,750	50	6	6	6	4	4	4	2	2	2	1	1	0	0	00	000	000	4/0	4/0
6,900	60	4	4	4	4	4	2	2	2	1	1	0	0	00	000	000	4/0	4/0	
8,050	70	4	4	4	4	2	2	2	1	1	0	00	00	000	000	4/0	4/0		
9,200	80	2	2	2	2	2	2	1	1	0	00	00	000	000	4/0	4/0			
10,350	90	2	2	2	2	2	1	1	0	00	00	000	000	4/0	4/0				
11,500	100	1	1	1	1	1	1	0	0	00	000	000	4/0	4/0					
13,800	120	0	0	0	0	0	0	0	00	00	000	4/0	4/0						

NOTE: For good voltage regulation design feeders for a maximum of one per cent voltage drop, branch circuits for a maximum of two per cent voltage drop.

Where wire larger than No. 10 is required to eliminate excessive voltage drop on branch circuits, split the circuits, or move the panel board closer to the load center.

Length of Run is the one-way distance from source of supply to panel or from panel to outlet. The length of wire required between these points is double this distance for 2-wire circuits and three times this distance for 3-wire circuits.

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